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BIOLOGICAL SCIENCES

LAMIACEAE MARTINOV, NOM. CONS. (= LABIATAE JUSS., NOM. CONS.) *STACHYS* L.

Novruzi Nurlana
Nakhchivan Teachers İnstitution
DOI: 10.5281/zenodo.7994734

Abstract

Mountain-xerophyte vegetation covers more than 50% of the territory of Garagush Mountain, one of the highest peaks of the Daralayaz range. Stachys inflata Benth., Stachys lavandulifolia Vahl. . (S. boissieri Kapell.) and Stachys rhomboidalis Grossh. belonging to the genus Stachys L. of the family *Lamiaceae* Martinov, nom. cons. (= *Labiatae* Juss., nom. cons.) in the formation of mountain - xerophyte (frigana) vegetation also participates.

The species belonging to the genus *Stachys* L. grow in sunny areas with medium moisture and dry soil. It is winter-hardy. It can spread by itself. It tolerates areas with little shade. It is found in sandy and rocky areas. It is most often found in the dry rocky slopes of the mountains of Iraq, Iran and the South Caucasus. It is an alpine plant. It is a tree-like herb or subshrub. It is used in folk medicine as a medicinal plant.

Keywords: Garagush mountain, Lamiaceae Martinov, nom. cons., Stachys L., S. inflata Benth., S. lavandulifolia Vahl. (S. boissieri Kapell.), S. pubescens Ten.

Mountain-xerophyte vegetation covers more than 50% of the territory of Garagush Mountain, one of the highest peaks of the Daralayaz range. The main reason is that the territory of the Nakhchivan Autonomous Republic has a severe continental climate. Since the summer is hot and dry, and the winter is harshly cold, xerophytic plants prevailed in the area. This led to the formation of mountain-xerophyte or phrygana vegetation. Stachys inflata Benth., Stachys lavandulifolia Vahl. (S. boissieri Kapell.) and Stachys rhomboidalis Grossh., belonging to the genus Stachys of the family Lamiaceae Martinov, are also involved in the formation of mountain xerophyte vegetation. Numerous formations and associations of this plant have been found in the area of Garagush Mountain. Various photographs of the plant were taken and analyzed (Figure 1). It is included in plant systematics as follows.

Classis: Angiospermae
Subclass: Magnoliidae
Ordo: Lamiales Bromhead
Familia: Lamiaceae Martinov, nom. cons. (= Labiatae Juss., nom. cons.) Genus: Stachys L.

1. Stachys fominii Sosn.
2. S. inflata Benth.
3. S. lavandulifolia Vahl. (S. boissieri Kapell.)
4. S. pubescens Ten.
5. S. stschegleewii Sosn.

Species of the genus Stachys L. grow in sunny areas with medium moisture and dry soil. It is winter-hardy. It can spread by itself. It tolerates areas with little shade. It is found in sandy and rocky areas. It is most often found in the dry rocky slopes of the mountains of Iraq, Iran and the South Caucasus. It is an alpine plant. It is a tree-like herb or subshrub. Spreading up to 38 cm wide, the l. S. *lavandulifolia* Vahl. is 20-25 cm tall. The leaves are gray-green. Basal leaves 4-5 cm, oblong-lanceolate to oblanceolate, usually with silky hairs and entire margins. Root leaves are shorter and wider. Each of its pink flowers is 7-10 cm in size, borne on short hairy spikes covered with dense cotton threads, consisting of 2-6 florets. It blooms from late spring to early summer. In the area, the plant is found in May-June.

In the formation of the meadow bushes of Garagush Mountain, along with conifer juniperus, Acantholimon Boiss., Onobrychis Hill., Astragalus L., Astracantha Podlech, Daphne L., Thymelaea Mill., Asparagus L. and Thymus L., species belonging to the genus also play a major role Stachys L..

The transition to forest-shrub areas usually begins with sparse bushes. Juniperus foetidissima Willd., Rhamnus pallasii Fisch. & C.A. Mey., Rosa canina L., Lonicera iberica Bieb., Sorbus aucuparia L., Berberis vulgaris L., Cerasus microcarpa (C.A. Mey.) Boiss. and Pyrus caucasica Fed. in the formation formed by the species, cereal - herbaceous (Stachys pubescens Ten., Pedicularis caucasica Bieb., Euphorbia marschalliana Boiss., Reseda lutea L., Achillea tenuifolia Lam., Verbascum cheiranthifolium Boiss., Scutellaria karjaginii Grossh., Draba bruniifolia Stev., Ranunculus repens L. etc.) is involved (1, p.91).

S. lavandulifolia Wahl. It is used as a medicinal plant in folk medicine. It is known for its antidepressant and appetite stimulating effects. It is used for digestive disorders. Stachys species are used as herbal medicine and desert tea in Anatolia as well as Iran.



Figurel 1. Stachys lavandulifolia Vahl.

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CHEMICAL SCIENCES

SYNTHESIS OF NITROGEN-CONTAINING COOLIGOMER AND STUDY OF ITS INHIBITORY PROPERTIES

Guliyeva Guljamal,
Master student of Chemical Engineering
Azerbaijan State Oil and İndustry University
Naibova T.M.
Associate Professor of Chemical Sciences
Azerbaijan State Oil and İndustry University
DOI: 10.5281/zenodo.7994737

Abstract

At the time of rapid development of technology in all fields of industry worldwide, corrosion protection of equipment and facilities made of metal, mainly in oil refining enterprises, is one of the urgent problems. Much of this problem falls on the oil sector, as it is associated with the failure of equipment and metal structures due to atmospheric corrosion during oil and gas production, processing and transportation. These important problems caused by corrosion processes continue to grow every year, however, this problem also leads to a sharp change in the environmental factors of our planet.

Every year, 10-15% of manufactured metal parts fall into disrepair as a result of corrosion, and this struggle does not lose its relevance, but is increasing day by day. Although it is not possible to completely prevent the corrosion process, there are various ways to relatively reduce its speed, the simplest of which is the use of anti-corrosion inhibitors, which are also easy to apply.

One of the important problems is the use of modified cooligomers with nitrogen-containing organic compounds in the preparation of coating compositions and inhibitors in the corrosion protection of equipment and facilities used in the oil and gas production industry, as well as in oil refining enterprises. The use of anti-corrosion inhibitors in these industries has shown high through their expedient use. The use of corrosion inhibitors in industries has not only resulted in its effectiveness, but is also due to the fact that it has universal indicators and is cost-effective [1-2].

Modification of existing phenol-formaldehyde, epoxide and resorcin-formaldehyde oligomers with nitrogen-containing organic compounds with positive results leads to a decrease in the amount of free monomers in the composition by about 5-7 times, a multiple increase in temperature indicators with an increase in the mass of the molecule led to an increase in stickiness, toughness and degree of solidification, and performance indicators with an increase in functionality [3-4].

The novelty of the research work is that the resorcinol-formaldehyde oligomer modified by copolydensation method and obtained with a new composition, ecologically clean and economically favorable inhibitor is studied in resorvoir water taken from *"SHIRVAN OIL OPERATING COMPANY"*, sea water and ordinary water and the investigation of its areas of use.

Keywords: modification, cooligomer, corrosion, resorvoir water, inhibitor

In the research study, resorcinol-formaldehyde oligomer was modified with amide group compound and its inhibitory properties were studied for the first time. Modification of resorcinol-formaldehyde oligomer was carried out by sopolycondensation method in acidic environment. The main indicators of the so-oligomer obtained were studied. For the purpose of comparison, the resorcinol-formaldehyde oligomer was also synthesized in the laboratory under the same conditions and its main indicators were studied. It was found that the amount of free formaldehyde in the sooligomer decreased by about 2-3%, the softening temperature increased from 80^0C to 95^0C, and the density increased from 1150 kg/cm^3 to 1225 kg/m^3. The IR spectrum of both the modified oligomer and the unmodified resorcinol-formaldehyde oligomer was studied for comparison. From the comparative analysis of the spectra, it became clear that the process is a chemical modification, and the presence of an amide group in the newly obtained compound gave reason to use it as an inhibitor. In the second stage of the conducted scientific-research work, a formation water sample taken from "Shirvan Oil Operating Company" was used.The ionic composition and physical-chemical indicators of formation water were taken from the laboratory of the specified organization (Table1)

Table 1

Ionic composition of formation water, mg/l

Horizon	Total miner-alization,g/l	Viscosity,spz	Anions				Cations		
			Cl^-	$HCO3^-$	$SO4^-$	Naph-thenic acid	Na^+K^+	Ca^{++}	Mg^{++}
PsAr2	14.64-19.32	0.52-0.58	8956-11857	40-123	9	48	4390-5765	1012-1407	60-179
Ps2Ar2	17.86-27.09	0.57-1.02	10976-17073	62-92	7	47-119	5443-7368	931-1632	211-1245

In order to determine the inhibitory properties of the resorcinol-formaldehyde oligomer, experiments were first carried out in laboratory conditions. For this purpose, 20x40x2 mm steel-D samples were taken. The composition of the steel-D sample consists of elements such as carbon, 14.22%, manganese 14-65%, silicon 12-13%, sulfur - 5%, phosphorus - 4%.The amount of the inhibitor was calculated according to 1l of corrosion medium. The study was conducted at room temperature (20 ± 50^0C) for 6 hours with constant stirring. After the test period, the sample was washed, dried and weighed on an analytical scale. For the purpose of comparison, the experiment is also carried out in an environment without inhibitors, and the corrosion rate (k), protection degree (z), protection effect (γ) is determined by the gravimetric method [5]:

$$\text{Corrosion rate: } K=\frac{m_0-m_1}{st},\ q/m^2saat \qquad (1)$$

Here, m_0 is the weight of the sample before corrosion, g; m_1-mass of the sample after corrosion, q; S-sample area, m^2; t-study period;

$$\text{Protection degree: } Z=\frac{k_0-k}{k_0},\ \% \qquad (2)$$

Here, k_0 – corrosion rate without inhibitor, k – corrosion rate with inhibitor

$$\text{Protection effect: } : \gamma=\frac{k_0}{k} \qquad (3)$$

In order to check the effectiveness of the inhibitor, laboratory studies were conducted in a comparative manner in 3 environments - reservoir water, sea water and distilled water. Formation water was taken from 2 wells of "*SHIRVAN OIL OPERATING COMPANY*" (PsAr2 and Ps2Ar2) and tested on steel samples of different sizes. The concentration of the inhibitor was calculated according to 200, 400, 600 mg/l. 0.2, 0.4, 0.6 mg of cooligomer was dissolved in 10 ml of solvent and mixed separately for 6 hours. 0.2, 0.4, 0.6 mg of sooligomer was dissolved in 10 ml of acetone and the weight of the steel plate was calculated after 6 hours in the solvent medium. The protective efficiency, degree of protection, and corrosion rate of different amounts of inhibitor against the corrosion of carbon steel samples in formation water were calculated and shown. (Table2)

Table 2

Effect of modified resorcinol-formaldehyde cooligomer on corrosion of steel in formation water environment

Serial №	Horizon	Corrosion rate (k) in medium without inhibitor, g/m²hour	Inhibitor concentra-tion, mg/l	Modified resorcinol-formaldehyde cooligomer		
				K, g/m²hour	Z, %	γ
1	PsAr2	0,457	200 400 600	0,0014 0.0011 0,0007	99,7 99,8 99,9	387,8 493,6 775,7
2	Ps2Ar2	0,543	200 400 600	0,0021 0,0018 0,0004	99,5 99,6 99,9	217,6 253,8 114,2

The role of hydrogen in the corrosion process in aqueous, alkaline and acidic environments is important, and H_2S is considered the most dangerous factor.It causes corrosion of gas equipment, metal structures, tanks and pipelines.The next stage of the research was continued in sea water.The effect of the inhibitor on the corrosion of steel in seawater - the corrosion rate, the protection effect and the degree of protection - have been studied and shown in Table 3.

Table 3

Effect of modified resorcinol-formaldehyde cooligomer on corrosion of steel in seawater

Serial №	Horizan	Corrosion rate (k) in medium without inhibitor, g/m²hour	İnhibitor concentration, mg/l	Modified resorcinol-formaldehyde cooligomer		
				K, g/m² hour	Z, %	γ
1	PsAr2	0,543	200	0,0018	99,6	287,3
			400	0,0010	99,8	537,6
			600	0,0001	99,9	285,8
2	Ps2Ar2	0,457	200	0,0019	99,5	236,7
			400	0,0011	99,6	387,2
			600	0,0002	99,9	157,8

Corrosion of modified resorcinol-formaldehyde oligomer in distilled water environment was tested in both wells and shown in Table 4.

Table 4

Effect of modified resorcinol-formaldehyde cooligomer on corrosion of steel in distilled water environment

Serial №	Horizan	Corrosion rate (k) in medium without inhibitor, g/m²hour	İnhibitor concentration, mg/l	Modified resorcinol-formaldehyde cooligomer		
				K, g/m²hour	Z, %	γ
1	PsAr2	0,543	200	0,0030	99,4	181
			400	0,0017	99,6	135,7
			600	0,0004	99,9	319,4
2	Ps2Ar2	0,457	200	0,0030	99,3	148,0
			400	0,0011	99,7	415,4
			600	0,0003	99,9	152,3

It is clear from the conducted studies that many factors affect the corrosion process of equipment and facilities made of steel. These are influenced by the chemical composition, the concentration of the inhibitor, the nature of the corrosion environment, general mineralization and other factors. Thus, resorcinol-formaldehyde cooligomer modified with an organic compound containing amide group can be used as an inhibitor against corrosion of steel in the indicated environment[6].

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COMPOSITE BASED ON ACRYLAMIDE MODIFIED EPOXY-DIANE AND PHENOL-FORMALDEHYDE SOOLIGOMERS

Naibova T.M.,
Akbarova G.S.,
Hasanli P.M.,
Shirinov T.T.
Azerbaijan State Oil and Industry University, Azerbaijan,
1010, Baku, Azadliq Avenue 34
DOI: 10.5281/zenodo.7994763

Abstract
Epoxy-diene and phenol-formaldehyde oligomers were modified with acrylamide in an alkaline environment by the sopolycondensation method, their main indicators were studied and they were used as binders, and an anti-corrosion coating composition was prepared.

Keywords: oligomer, cooligomer, phenol-formaldehyde, epoxy-diene, modification.

Introduction

Oligomers or cooligomers, which belong to high molecular compounds, are used as linkers in the preparation of composites for various purposes. The rapid increase in demand for epoxy-diene and phenol-formaldehyde oligomers used as binders is due to their many valuable properties. However, along with valuable features, the presence of certain missing aspects is undesirable both from an ecological and economic point of view. After solidification of epoxy-diane and phenol-formaldehyde oligomer, fragility, resistance to heat and burning, low adhesiveness, and most importantly, free monomers remaining in the finished product are undesirable. It was modified with acrylamide to overcome the shortcomings of these oligomers used as linkers. The shortcomings of sooligomers functionalized by chemical modification method have been eliminated, and the areas of application of the composite prepared on their basis have been determined [1-3].

Statement of the problem

The goal is to obtain a functionalized sooligomer with a new composition by modifying the existing oligomers in an alkaline environment with an organic compound containing an amide group through chemical modification, to determine the composition and main indicators with physico-chemical, physico-mechanical and spectral analysis, as well as to use functionalized so-oligomers as a linker. to prepare an anti-corrosion coating composition.

Methodology

For the purpose of comparison, the main indicators and spectral analyzes of unmodified epoxy-diene and phenol-formaldehyde oligomers were studied in parallel. It was found that after the modification process, the main indicators increased, and the amount of free monomers decreased. (tables 1 and 2)

Table 1.

Key indicators of epoxy-diane oligomer and acrylamide-modified epoxy-diane sooligomer.

№	Indicators	Epoxy-diane oligomer	Epoxy-diane sooligomer
1	External appearance	Light brown	Light yellow
2	Amount of epoxy groups, %	17.2	11.5
3	Amount of volatile compounds, %	0.005	0.003
4	Gelatinization time, hours (120^0 – 130^0 C)	5-6	3-4
5	Molecular mass	500	748
6	Softening temperature, ^{0}C	80	85
7	Density, kg/m^3	1250	1320

Table 2.

Key indicators of phenol-formaldehyde oligomer and acrylamide-modified phenol-formaldehyde sooligomer.

№	Indicators	Phenol-formaldehyde oligomer	Phenol-formaldehyde sooligomer
1	External appearance	Light brown	Dark brown
2	Amount of free phenol, %	14.87	3-5
3	Amount of free formaldehyde, %	8.96	3.6-4.8
4	Amount of hydroxyl groups, %	17.28	10.61
5	Molecular mass	450	960
6	Degree of solidification, % (140^0C for 5 hours)	92.6	97.8
7	Softening temperature, ^{0}C	65	70
8	Density, kg/m3	1186	1250

The fact that the functionalization process of existing oligomers by the copolycondensation method is a chemical modification is reflected in the spectral analysis (pictures 1 and 2).

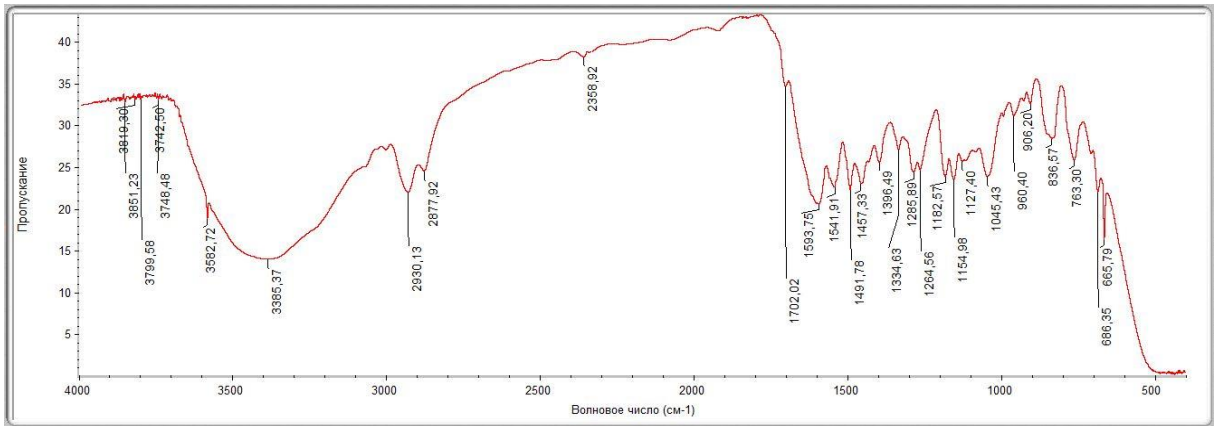


Figure 1. IR spectrum of modified epoxy-diane sooligomer.

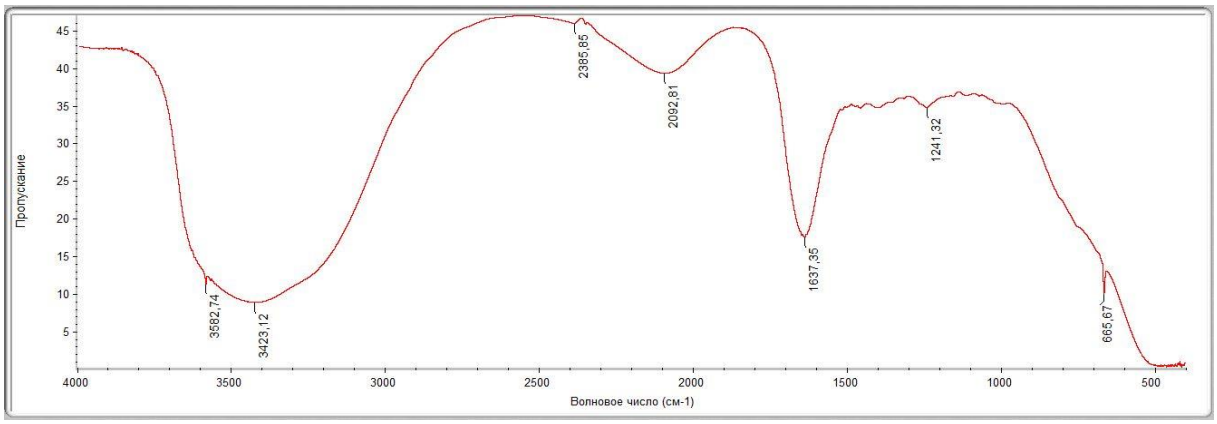


Figure 2. IR spectrum of modified phenol-formaldehyde sooligomer.

Thus, the IR spectrum of the epoxy-diane sooligomer modified with acrylamide shows the valence vibration of NH and -OH bonds in the absorption band of 3385.37 - 3851.23 cm^{-1}, the valence vibration of the CH bond in the absorption band of 2877.92 - 2930.13 cm^{-1}, 1541 .91 - 1702.02 cm^{-1} deformation vibration of the C=O and NH bonds with the benzene ring, 1264.56 - 1396.49 cm^{-1} absorption band deformation vibration of amine groups, 1045.43 - 1182.57 cm^{-1} the absorption band 1 shows the deformation vibration of the -OH bond at 906.20 - 960.40 cm^{-1}, the deformation vibration of the CH bond, and finally the deformation vibrations of the epoxide groups at 763.30 - 836.57 cm^{-1}.

In the IR spectrum of the phenol-formaldehyde sooligomer modified with acrylamide, the intense absorption band at 3423.12 cm^{-1} indicates the valence vibration of -OH and NH bonds, the deformation vibration of the weak NH bond at 2092.81 cm^{-1}, and the intense absorption band at 1637.35 cm^{-1} valence vibration  and a weak absorption band at 665.67 cm^{-1} indicates the presence of deformation vibration of the CH bond.

Modified sooligomers were studied in differential thermal analysis (Figures 3 and 4).

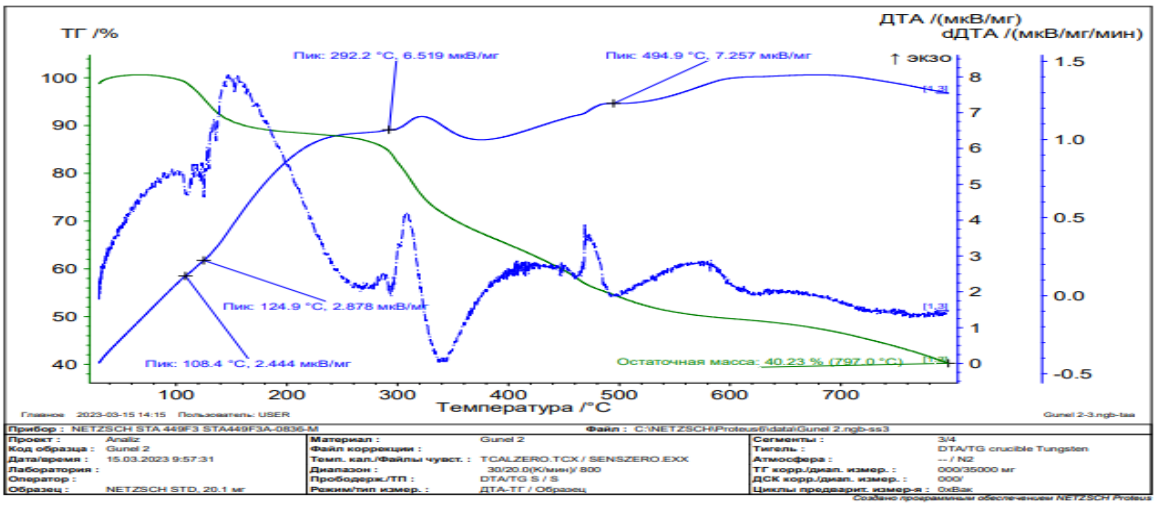


Figure 3. DTA spectrum of modified epoxy-diane sooligomer.

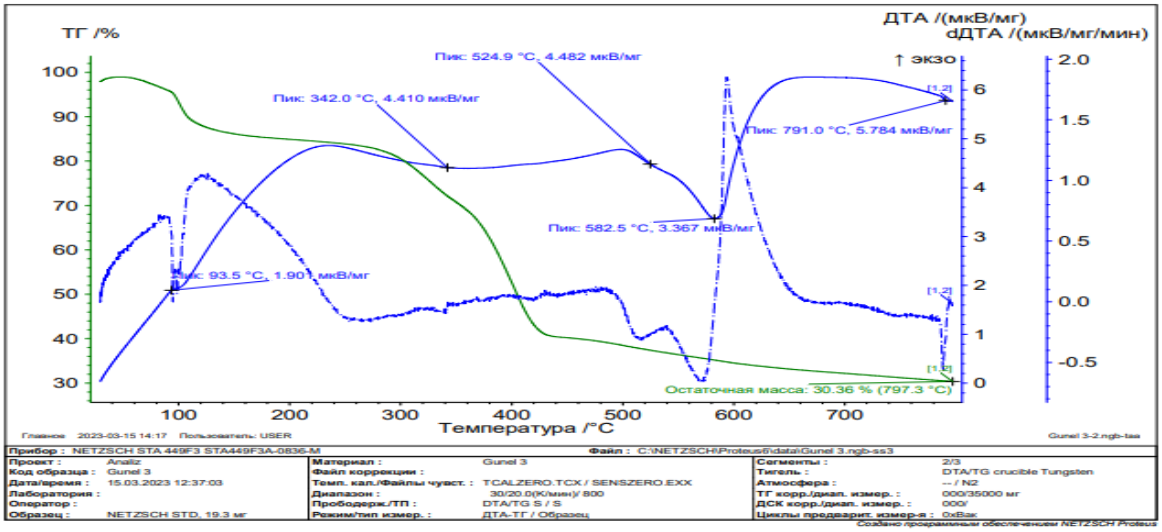


Figure 4. DTA spectrum of modified phenol-formaldehyde sooligomer.

It is clear from the pictures that the destruction process of epoxy-diane sooligomer (picture 3) and phenol-formaldehyde sooligomer (picture 4) goes through three stages. In the first stage (at 200°C), the main destruction product is water, in the second stage, i.e. (at 200-300°C), breaking of functional groups is observed as the oxidation process takes place, and at this time, low-molecular compounds, mainly oxides, are formed. At the last stage of the destruction process, intense dehydrogenation and carbonization of the residue takes place. The coke number at 797.0°C in epoxy-diene sooligomer was 40.23%, and the coke number at 797.2°C was 46.36% in phenol-formaldehyde sooligomer.

It has been established that, regardless of the conditions of destruction, the presence of oxygen in the sooligomer has a thermooxidative nature and the bonds are broken. A coating composition based on modified epoxy-diene and phenol-formaldehyde sooligomers was prepared and its main indicators were studied. The composition of the coating composition is as follows (k.h):

Epoxy-dian sooligomer - 45.0

Phenol-formaldehyde sooligomer - 50.0

Inorganic filler - 5.0

First, the sooligomers are dissolved separately in an organic solvent, mixed, and then a calculated amount of inorganic filler is added. It is mixed for 0.5-1.0 hours at room temperature until a homogeneous mass is obtained. The prepared coating composition is hardened by the thermal method (at 140°C for 4 hours), then the main performance indicators are determined. It was found that the coating composition made on the basis of sooligomers is resistant to water, oil, gasoline, weak alkaline and acid solutions. The hardness of the coating is 0.48 : 0.70; impact resistance 45-50 kg/cm; and its elasticity was in the range of 3-5 mm.

It is recommended to use it in corrosion protection of the equipment and facilities operated in the oil and gas extraction industry.

In conclusion, this thesis investigated the modification of epoxy-diene and phenol-formaldehyde oligomers through the incorporation of acrylamide in an alkaline environment using the sopolycondensation method. The main indicators of these modified oligomers were studied, and their potential as binders was

assessed. Additionally, an anti-corrosion coating composition was successfully prepared using these modified oligomers.

Furthermore, the potential application of these oligomers in modifying thermoplastics and enhancing their properties was explored. The utilization of acrylamide-modified epoxy-diene and phenol-formaldehyde oligomers as additives for thermoplastic materials holds significant promise. By incorporating these modified oligomers into thermoplastic matrices, it is anticipated that notable improvements can be achieved in mechanical strength, thermal stability, chemical resistance, and adhesion.

Results

1. For the first time, epoxy-diene and phenol-formaldehyde oligomers were modified with acrylamide and their main indicators were studied.

2. It was found that functionalization of oligomers with amide group compound eliminated their deficiencies.

3. A coating composition was prepared using the sooligomers with a new composition as a linker and its main indicators were studied.

4. Durability of the coating composition in different environments was checked.

5. It is recommended to use the coating composition made on the basis of sooligomers in corrosion protection of equipment and devices operated in aggressive environments.

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ECONOMIC SCIENCES

DEVELOPMENT OF ENTREPRENEURSHIP IN AZERBAIJAN

Hasanova Khanim Etibar gizi,
Bayramova Zenfira Bayram gizi
senior lecturers,
Azerbaijan State Agricultural University,
Ganja, Ataturk Avenue 262
DOI: 10.5281/zenodo.7994791

РАЗВИТИЕ ПРЕДПРИНИМАТЕЛЬСТВА В АЗЕРБАЙДЖАНЕ

Гасанова Ханум Ехтибар кызы
Байрамова Зенфира Байрам кызы,
Старшие преподаватели,
Азербайджанский Государственный Аграрный Университет,
г.Гянджа, проспект Ататюрка 262

Abstract

The development of entrepreneurship, the implementation of fundamental reforms in order to create a favorable business environment follows from the requirements of the economic development strategy implemented under the leadership of President Ilham Aliyev. The article considers the provision of sustainable and balanced development of the country's economy. The article also discusses the prospects for the development of regions, which is one of the priorities of the current stage of the socio-economic development of our country and is successfully implemented within the framework of the adopted targeted state programs.

Аннотация

Развитие предпринимательства, проведение фундаментальных реформ с целью создания благоприятной деловой среды вытекает из требований стратегии экономического развития, реализуемой под руководством Президента Ильхама Алиева. В статье рассмотрено обеспечение устойчивого и сбалансированного развития экономики страны. Так же в статье рассмотрены перспективы развития регионов который является одним из приоритетов современного этапа социально-экономического развития нашей страны и успешно реализуется в рамках принятых целевых государственных программ.

Keywords: entrepreneurship, state support, implementation, capital, financing

Ключевые слова: предпринимательство, государственная поддержка, реализация, капитал, финансирование

Цель работы получение прибыли от потраченного капитала, финансовых, ресурсных и материальных средств на ту или иную деятельность за определенный период времени, удовлетворение потребительского спроса, его конкретных потребностей.

Материалы и методы. В Азербайджане политика в этой сфере направлена на обеспечение реализации государственной поддержки предпринимательства в системной форме, повышение эффективности мер государственной поддержки предпринимателей. По реализации этого стратегического направления принимаются последовательные меры. Создан механизм государственной финансовой поддержки предпринимательства, который служит важным реальным источником удовлетворения финансовых потребностей малых и средних предпринимателей.

Обеспечено создание в Азербайджане Фонда поощрения экспорта и инвестиций, деятельность которого направлена на увеличение экспортных возможностей страны и привлечение иностранных инвестиций. Развиты государственно-предпринимательские отношения, предприняты значительные шаги по совершенствованию системы государственного регулирования предпринимательства. Созданы рабочие механизмы по защите прав предпринимателей, в результате их применения количество случаев вмешательства снизилось. Регулярно принимаются меры по усилению предпринимательского консультирования, информационного обеспечения и развития деловых отношений.

С 1 января 2008 года обеспечена организация деятельности хозяйствующих субъектов по принципу «единого окна». После внедрения системы «единого окна» процедуры открытия бизнеса в Азербайджане были сокращены с 15 до 1, а время, затрачиваемое на это, сократилось с 30 до 3 дней. После внедрения данной системы количество зарегистрированных юридических лиц значительно увеличилось[1].

В результате адресных мер доля частного сектора в ВВП достигла 85%.

В целях обеспечения устойчивого развития предпринимательства в стране внедрена институциональная организация партнерства государства и предпринимателей. В связи с этим, созданные механизмы (Агентство по развитию малого и среднего предпринимательства, Азербайджанский фонд поощрения экспорта и инвестиций, учебные бизнес-центры и др.) Играют важную роль в развитии отношений между государством и предпринимателем на гражданском уровне.

В 2021 году Азербайджанский фонд поощрения экспорта и инвестиций (AZPROMO) был создан для достижения приоритетных целей по увеличению экспортного потенциала страны и привлечению иностранных инвестиций. Фонд активно поддерживает предпринимателей в увеличении экспортного потенциала предпринимателей страны, расширении инвестиционных возможностей, поиске потенциальных партнеров и реализации совместных проектов сотрудничества.

Министерство экономики и Азербайджанский фонд поощрения экспорта и инвестиций (AZPROMO) проводят важные экономические мероприятия в этом направлении как внутри страны, так и за ее пределами, включая бизнес-форумы, выставки, семинары и конференции. Эти мероприятия важны как для продвижения деловой среды и экономического потенциала страны, так и для развития деловых контактов местных предпринимателей. В частности, мероприятия, проводимые в зарубежных странах, показывают свои положительные результаты в увеличении объема инвестиций в приоритетные направления экономики страны.

Указом Президента Азербайджанской Республики «О совершенствовании механизма государственной поддержки развития предпринимательства в Азербайджанской Республике» от 31 июля 2018 года был учрежден Фонд развития предпринимательства как публичное юридическое лицо при Министерстве экономики[2]. В целях более эффективного использования льготных кредитов годовая процентная ставка по кредитам из Фонда развития предпринимательства снижена с 6% до 5%. Вместе с тем, новые правила изменили лимиты выдачи средних кредитов с 50 001 до 1 000 000 манатов.

К настоящему времени принято множество законов, направленных на совершенствование правовой базы предпринимательства. Одним из таких законов, способствующих развитию предпринимательства, является Закон Азербайджанской Республики «О регулировании проверок в сфере предпринимательства и защите интересов предпринимателей», принятый 2 июля 2013 года[3].

В законе отражены цели и принципы проверок в сфере предпринимательства, правила организации и проведения, права и обязанности проверяющих органов и должностных лиц, вопросы, связанные с защитой прав и интересов предпринимателей. Основная цель закона - установить единые правила проведения проверок в сфере предпринимательства и предотвратить незаконное вмешательство в деятельность предпринимателей во время проверок. Все виды проверок, проводимых на территории страны, должны проводиться только в случаях и в порядке, предусмотренных настоящим Законом, с предварительной регистрацией в едином информационном реестре[4].

В ведущих странах мира применяются различные экономические модели развития предпринимательства. Одна из таких моделей - особые экономические зоны. Целью создания особых экономических зон является ускорение развития приоритетных секторов экономики, создание более благоприятных условий для привлечения местных и иностранных инвестиций, поддержка развития высокотехнологичных производств, организация конкурентоспособного, эффективного производства и услуг.

В Азербайджане ведется соответствующая работа по созданию новых моделей развития предпринимательства - особых экономических зон, индустриальных парков и микрорайонов, агропарков.

Результат

В настоящее время систематически и последовательно принимаются меры по расширению предпринимательства и повышению его роли в экономике, а также по дальнейшему улучшению делового и инвестиционного климата в стране. Реформы проводятся в сфере поддержки частного сектора, защиты прав и интересов предпринимателей в соответствии с новыми экономическими условиями, применяются механизмы, отвечающие современным потребностям, для развития этого сектора с учетом международного опыта. В результате государственной поддержки предпринимательства количество субъектов предпринимательства за последние 17 лет увеличилось в пять раз, доля частного сектора в ВВП превысила 85 процентов, а его доля в занятости превысила 76 процентов.

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HISTORICAL SCIENCES

HISTORICAL AND DEMOGRAPHIC ISSUES RELATED TO ANCIENT BELIEFS, CUSTOMS AND CEREMONIES OF THE AZERBAIJANI PEOPLE (ON THE BASIS OF AZERBAIJANI HISTORIOGRAPHY IN SECOND HALF OF THE XX - EARLY XXI CENTURIES)

Mammadov Aydin
PhD in history, associate professor
Department of "Source study, historiography and methods" of Baku State University
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Abstract
The Azerbaijani people are one of the most ancient peoples of the world. In Azerbaijan, even in antiquity there was a great propensity for large families. Many rites of Azerbaijan contain rich demographic elements. In Azerbaijan, some of these customs still exist. For example: during childbirth, near the bride were midwifes, mother of a daughter-in-law, and an older sister. After giving birth, the daughter-in-law was given sherbet, the girl's navel was buried on the doorstep in the corner of the room, and the boy's navel was buried in a mosque or in a stall. Until the end of 40 days, did not allow strangers to the child. These customs gave impetus to the increase in the number of marriages. People, the newlyweds knew each other before the wedding so the families were strong and the number of fertility was a lot.

Keywords: historical demography, Azerbaijan traditions and customs, ancient beliefs of the Azerbaijan people, the cult of the Sun, Azerbaijani historiography.

It is possible to find numerous valuable and interesting information about historical and demographic issues (such as growth and birth) in the ancient beliefs of the Azerbaijani people. According to the oldest beliefs of the Azerbaijani people, everything that is alive must grow, reproduce, take root like a tree, and branch out like tree branches. It is no coincidence that Azerbaijani people has a word of blessing: "I want that you to have a thousand branches like a tree". In this word of blessing, the worship of the tree of life, which is one of our ancient beliefs, is reflected. In many Turkic-speaking peoples, including other peoples, the goddess of birth and fertility is identified with a tree, and often with a plentiful tree, or is depicted as a double tree. For example, one of the seals found from the Sumerian city-state of Uruk depicts Inanna, the goddess of birth and fertility, holding the tree of life. So, since the most ancient times, people have imagined plentiful trees in a closely related manner related to demographic processes such as growth and reproduction.

M. Mathieu notes that in many ancient mythological belief systems, the creation of the sky and the universe is associated with a tree. According to one of these beliefs, the child of the Sun, that was once in darkness, was formed in the petals of a lotus towering on a high elevation. This is how the lotus that grew on the hill near the city of Shmunu gave life to the young Sun Goddess. The description of the lotus flower, with the holy child sitting among its petals, is found in the legends of the Roman period [11, p.15-16]. In this example, the "coming out" of the plant and the sun as the parents of the "holy child" actually proves once again that people associate growth and population settlement only with natural favorable factors. That is, from the earliest times, our great ancestors understood that wood, sun, air, water, and soil are important components for normal living, reproduction, and generation on earth, and they valued the absence of any of these factors as the end of life. The tree of life, which is a symbol of life and growth on earth, was seen as a unity of these four sacred elements: "In ancient Azerbaijan, the tree of life was known as a symbol of the noblest and highest ideals of Azerbaijani people, as a sign of immortality and eternal life. The connection between the tree of life imaginations and the sun symbol has traditionally been passed down from generation to generation" [14, p.54-55].

The depiction of the goddess protecting birth and growth together with a tree on the artistic embroidery attributed to the Altai Turks in the Hermitage museum confirms the above once again. The image on that art sample, which belongs to the IV-III centuries, clearly shows that the ancient Turkic-speaking peoples treated the tree of life as the protector of birth. According to M. Seyidov: "The "world tree" is considered the creator and protector of the whole world, as well as people. If such a belief prevailed, then Umay, the goddess who protects children with a tree, should naturally be associated with a tree" [13, p.37]. A number of Turkic-speaking peoples believed that the tree of life descended from the sky together with Umay, the goddess who protects birth and children. The association of Umay, the goddess of birth, with the plentiful tree was due to the fact that both were directly related to growth and reproduction, as mentioned above. That is, if the tree bears fruit and grows, the goddess Umay also helps the birth of people, which ensures the increase of generations; she patronized pregnant women and their children.

The traditions, customs and rituals of the Azerbaijani people are distinguished by their primacy, completeness of content and thematic extensiveness among the national cultures of the peoples of the world. These customs and rituals were formed as a result of the centuries-old history of cohabitation of the Turkic peoples.

Many of them reflect the beauty characteristic of ancient times. From this point of view, the rituals associated with the worship of the Sun, folk beliefs are of great interest. The cult of the Sun or worship of the Sun, which is one of the ancient traditions of Azerbaijan, retaining its incarnation in the customs of Nowruz, could be preserved from the ancient times of our ancestors to the present day in one form or another. Sun plays a decisive role for the existence of life, development, progress and improvement on our planet [10, p.209]. Our morning begins with the first rays of the sun peeking over the horizon, and everyone starts their working day. In the early stages of human existence, there was no artificial light. People used only Sunlight and Moonlight, and in their absence they found themselves in complete darkness. Therefore, our ancestors worshiped the Sun and the Moon [1, p.44].

In honor of the sun, a sacrifice was made. According to the "father of history" Herodotus, the Massagetae tribes living in the modern territory of Azerbaijan considered the sun to be the only God and sacrificed a tree to a horse [6, p.234; 4, p.478]. Azerbaijani historians K.Aliyev and F.Aliyeva wrote: "Some ancient tribes living in the modern territory of Azerbaijan considered the long-lived oak as a symbol of population growth and prosperity and brought this tree as a horse sacrifice, they splashed the bark of this tree with the blood of a killed horse" [3, p. 63]. According to the ancient astral view of the Azerbaijani people, the horse and the bull were considered a symbol of the sun, as well as a symbol of prosperity and population growth. The sacrifice of a horse to the sun, as well as the frequent images of a bull in the rocks of Gobustan, confirm the connection between the sun and the Earth [5, p.214; 4, p.478].

Thus, the cult of the Sun originated as a result of the need of our ancestors for light and warmth, their attitude to the environment, and over the course of millennia, it influenced the development of man and the formation of sacred thinking. Then our ancestors, in order to bring themselves closer to the sun, to become a relative with it, created images that included mythical creatures, created images, the status of the sun as a document of sacredness. One such being was "Al Ruh" (literally – "red spirit"), that fought against the forces of darkness, the enemies of slander. Belief in "Al Ruh" is still preserved in some areas of Azerbaijan, customs and traditions. When the sun and moon were darkened, people united their efforts and helped the sun. Regarding this, N.Rzayev writes: "In Azerbaijan at the end of the XIX and beginning of the XX centuries, Al Ruh was opposed to evil spirits as a good spirit. When the sun and moon were eclipsed, they called him for help. In the beginning, fires were lit, salutes and guns were fired, and drums were beaten so that the sun or moon would get rid of evil spirits" [12, p.42; 7, p.164].

In the ancient beliefs of the Azerbaijani people, there was the image of Humay, who protected pregnant women, newborn children, the family hearth from any evil spirits, and also patronized the growth of the population. Most likely, these female images were associated with the period of matriarchy, when the genus was considered on the maternal side. Later, these female images patronizing the population were associated with the cult of the sun. Yellow and red color in the ancient beliefs of the Azerbaijani people personified the fire of the patronizing sun. That is why, both Albasti and Humay were depicted as a virtuous woman with golden yellow, red braids. Therefore our ancient ancestors took care of their future children and held a series of rituals and measures to protect pregnant women from the negative effects of evil spirits. For example, pregnant women's blankets and head coverings were made of red cloth.

Thus, the wealth of ancient beliefs, customs and rituals of the Azerbaijani people related to family values, caring for pregnant women and newborn children, population growth is indisputable evidence of the richness and antiquity of the demographic views of our people, which have made a valuable contribution to human civilization.

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PEDAGOGICAL SCIENCES

RESEARCH ON THE APPLICATION OF TPACK TECHNOLOGY IN COLLEGE TEACHING

Zhang Jiaqi,
2nd year master's student
KazNPU named after Abai
Gulbanu Abitova
doctor of philosophy, associate professor KazNPU named after Abai, Kazakhstan
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Abstract
Under the guidance of the 13th Five Year Plan, the application of TPACK can effectively activate traditional education models, accelerate educational transformation, expand educational horizons, increase educational diversity, and better meet the needs of society for more advanced knowledge and services. It also helps to establish a "Double First Class" system, thereby improving the educational level of universities and ultimately achieving the goal of a smart campus.

Keywords: TPACK; Higher Education; Quality of education and teaching

1. Introduction

Due to the advancement of technology, high-tech has become an important technology applied to all industries in the industry, and its role cannot be ignored. Especially in the education industry, it not only involves general knowledge, but also involves more practice. Therefore, it faces more challenges and requires more proactive measures to accelerate educational transformation and achieve higher levels of educational effectiveness. The 13th Five Year Plan also provides guidance for this. In order to promote the development of universities and restore traditional educational models, we must closely combine theoretical research, creative thinking, and practical applications.

1.2. The Role of Teachers in the Age of Artificial Intelligence

With the development of modern science, more and more people have the oppority to acquire and share knowledge through modern information technology, which has brought about revolutionary changes in the field of education in the future. Vice Minister of Education Du Zhanyuan stated that with the development of science, more and more scholars have higher learning levels and better literacy. By utilizing advanced information technology and creative thinking, teachers can convey knowledge to students in the most precise way, thereby benefiting them greatly. Teachers not only possess rich professional literacy, but also must possess excellent classroom performance and practical operations, as well as good information collection and analysis abilities. Through continuous reform and improvement, university teachers can provide high-quality courses and eliminate low-quality courses, thereby creating more competitive, creative, and challenging high-quality courses.

2. Education Informationization Teaching

With the progress of technology, information technology has deeply influenced our teaching mode. Nowadays, we can improve our abilities by using various emerging technologies such as MOOCs, flipped classrooms, micro classes, virtual reality, mobile learning, educational informatization, intelligent education, and makers. In the current era of artificial intelligence, teachers must be more actively involved in educational reform in order to better adapt to market competition. The philosophy of 'the only constant is change' also illustrates this point. Director Wu Yan emphasized that the diversity of higher education should be actively expanded to meet the society's demand for high-quality talents, combining modern information technology with traditional education and teaching, strengthening the quality of education and teaching, and enhancing teachers' educational abilities to meet the society's demand for high-quality talents.

2.1. The Impact of TPACK on Teachers

Based on a questionnaire survey of TPACK among teachers in five universities in Urumqi, Zhou Haitao emphasized that teachers can enhance the various elements of TPACK among university teachers by strengthening self-reflection and creating a teacher teaching community. [3] Ren Xiuhua and Ren Fei constructed a TPACK knowledge structure framework for university teachers based on the knowledge structure characteristics of university teachers. Through a survey questionnaire, they analyzed the correlation between teaching experience, training frequency, teacher education background, and TPACK of university teachers. Based on the TPACK structure characteristics presented in the research results, they proposed to enhance teachers' TPACK ability by conducting diversified training, developing situational learning activities, and building collaborative groups, Promote the professional development of in-service teachers and the training of pre-service teachers. [4] In the era of artificial intelligence, professional and disciplinary construction should pay more attention to innovative concepts, and curriculum construction should be more open and transparent. So, how to continuously improve the teaching effectiveness of higher education and evaluate students' learning outcomes is worth our attention.

2.2.TPACK Introduction

Since the 1990s, due to the popularization of information technology, Punya Mishra and Matthew J. Koehler at Michigan State University in the United States have borrowed Schulman's learning theory and developed this new teaching method, which combines knowledge and methods organically to achieve optimal teaching results. TPACK, as a comprehensive educational tool, aims to help teachers better understand and apply the skills they possess, thereby enhancing their overall quality. It not only helps teachers better master the required knowledge, but also helps them better apply these technologies to improve the quality of their teaching.

Through in-depth exploration of TPACK, teachers can better grasp and apply the most advanced educational concepts, thereby better guiding the classroom. The composition of TPACK includes three main parts: TK, CK, PK [5], which form a complete curriculum system, and the four parts are PCK, TCK, TPK, and TPACK [6]. These four parts form a complete curriculum system, which can help teachers better grasp the course content and better apply the latest educational concepts.

With the development of artificial intelligence, the role of teachers has also undergone significant changes, and their responsibilities have become increasingly complex. The TPACK framework advocates that teachers should be familiar with both the theory of the curriculum and relevant technologies, and combine these knowledge to adapt to the current educational environment. This method can not only demonstrate the professional level of teachers, but also enable them to achieve the best classroom effect.

3. Modernized teaching mode of education

3.1. Deauthoritative Role of Teachers

As a teacher, we need to be more actively involved in the classroom and guide, motivate, coordinate, and cultivate students' independence through intelligent methods, so that their thinking can be fully cultivated. We also need to dare to challenge traditional teaching methods and encourage them to establish a good atmosphere of communication, cooperation, and mutual growth with others.

3.2.Students Expect to Teach Students According to Their Aptitude

Teachers not only need to impart a lesson plan to first level students, but also have a deep understanding of students' learning characteristics, and combine various educational resources such as MOOC and micro courses to provide targeted and efficient guidance, thus achieving an organic combination of education and teaching.

3.3.Backward teaching methods of teachers

With the development of technology, the blackboards, chalk, projectors, and other traditional educational resources in the classroom cannot meet the demand for high-quality courses in today's society. Therefore, it is crucial for teachers to utilize emerging technologies such as the internet and mobile devices to improve the quality and effectiveness of their courses. In today's fast-paced information society, one class is enough time to impart a complex concept to everyone. However, how can we utilize limited resources on the internet to transform the energy of one class into an effective micro class to meet current needs and gain recognition from students?

3.4.Education and research capabilities need to be improved

Teachers should actively explore new teaching methods, combining the latest scientific knowledge with practice, in order to enable students to better grasp the latest developments in the subject. They should play a dual role as educators and Sub-I, constantly exploring the reform of classroom teaching to enhance their research capabilities. Teachers should not only teach professional courses, but also strive to cultivate students' skills in literature search, analysis, and practical writing.

3.5.Education evaluation methods need to be improved

By introducing various educational measurement tools, such as intelligent assessment and multimedia assistance, it can effectively help teachers and students better grasp classroom content, stimulate their learning interest, cultivate their innovation ability, and effectively transform classroom content into practical actions, thereby better promoting the development of the classroom.

4. Advantages of TPACK in New Teaching Models in Universities

4.1. Development process of instructional design

With the popularization of new media technology, the schools of Shaanxi International Business Research Institute have successfully combined IT, classrooms, learning resources, etc. closely to form a comprehensive teaching method, providing students with the opportunity to explore, learn, and communicate, thus creating a unique teaching environment that enables students to better understand and master the knowledge they have learned [7], and also helps them better apply the theories they have learned, To achieve better learning outcomes. Utilize the Internet and other TPACK tools, such as TPACK, to help teachers better understand and grasp the key points of the course, and be able to use these tools to improve classroom effectiveness. In this way, teachers can better utilize these tools and better guide other teachers, promoting the progress of the entire classroom..

4.2.Construction of TPACK integration mode

Within the framework of TPACK, a key factor is' context '. According to Dr. Mario Antonio Kelly, [8] TPACK involves a school that is influenced by multiple factors such as physical conditions (including software and hardware infrastructure), family education history, cognitive characteristics, psychology, and class spirit, thereby forming a complete learning atmosphere. The overall operational requirements of TPACK are very clear, so we must attach importance to grasping the situation. At the same time, we also need to equip teachers with TPACK skills [9] and the important roles they play in this operation process.

The structural framework of TPACK is subject to many limitations, such as the selection of course content and the teaching methods of teachers. Therefore, when constructing a TPACK integration model, we

need to deeply integrate TK and CK, and use TPK to create interesting learning situations and stimulate students' learning enthusiasm. Therefore, the TPACK, PCK, TPK, and TCK levels of teachers have a significant impact on their comprehensive and deep integration abilities. In order to effectively improve the quality of undergraduate teaching, we should adopt the TPACK integrated teaching model in order to achieve the best teaching effect.

4.3.Advantages of TPACK integration mode

TPACK integration mode aims to build a comprehensive, comprehensive and highly flexible curriculum system by using the most advanced AI technology, combining the three traditional concepts of "TK", "CK" and "PK", as well as the three cutting-edge elements of "PCK", "TCK" and "TPK", so as to help learners better master the required subjects and better use these elements to improve their learning level. By adopting various methods, such as using testing tools, we can effectively teach information technology [10], providing strong support for improving the quality of education in universities.

4.4.Application of TPACK integration mode in teaching system reform

Based on information-based education, we are committed to achieving better education and learning by enabling learners to have more independent thinking and action. We are working hard to promote TPACK's educational method, making it more widely used in our classrooms, and helping our teachers better achieve information-based education in the context of informatization.

4.5.Teachers' own conditions

Teachers should strive to improve their subject knowledge and skills, and continuously strengthen their ability to integrate knowledge. In addition, they should also conduct more practical exercises in the classroom, develop an effective TPACK architecture based on teaching themes and students' characteristics, and continuously update teaching methods to improve teaching quality.

4.6. Teachers' Self reflection

In order to enhance the professional level of teachers, enhance TPACK skills, and perfectly integrate into the classroom, continuously improve the classroom content. Regularly reflect on classroom content and continuously explore the potential value of the classroom, in order to truly solve problems in the classroom [11].

5. Intelligent mobile terminal teaching

With the development of the Internet, intelligent mobile terminal teaching has become an effective way that is not limited by geography and time. It not only allows teachers to teach better, but also helps students understand knowledge faster. At the same time, high-quality micro course resources can also allow students to easily acquire knowledge outside of class.

5.1. Schools should strengthen institutional construction

Teachers should actively explore new teaching models and innovative methods, and incorporate them into the credit management system to measure their TPACK teaching ability, and encourage them to integrate these technologies into higher education teaching to improve teaching quality.

In order to better promote the development of universities, we should improve a comprehensive curriculum assessment mechanism in order to objectively and accurately evaluate the quality of teaching. This mechanism should cover teachers' information-based teaching skills, classroom teaching quality, online viewing volume, learners' understanding of the taught topic, and how to organize and implement these mechanisms [12]. Reforming the form of final exams and adopting a comprehensive and comprehensive evaluation system can allow teachers to flexibly guide students based on actual situations, thereby improving their learning status, motivating them to constantly explore and realize their self-worth, greatly improving the classroom atmosphere and greatly enhancing the level of education in the classroom.

Conclusion

The use of TPACK has laid a solid foundation for the implementation of improving the quality of education and teaching. Its operation has greatly benefited teachers' professional quality, technical application, situational mood, and other aspects. Moreover, the operation of TPACK has brought positive impacts to their career. Through in-depth reform of traditional teaching methods, we hope to play a better role in intelligent campuses. This will greatly enhance the abilities of teachers and bring more opportunities for their professional development. We will also combine artificial intelligence theory to bring a new perspective to contemporary teachers, and continuously try and promote this new TPACK integration model through the use of TPACK. This will enable us to better integrate our knowledge into the classroom, thereby better promoting our higher education and achieving better national standards, laying a solid foundation for the development of talent.

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THE FOFMATION OF LEXICAL COMPETENCE AT THE GERMAN LANGUAGE LESSONS

Kazak Yu.Yu.
Doctor of Philosophy, Senior Lecturer
at the Department of Theory and Practice of Foreign Languages
Pavlo Tychyna Uman State Pedagogical University
Ukraine, Cherkassy region, Uman, Sadova street, 2
DOI: 10.5281/zenodo.7994825

ФОРМУВАННЯ ЛЕКСИЧНОЇ КОМПЕТЕНТНОСТІ НА ЗАНЯТТЯХ З НІМЕЦЬКОЇ МОВИ

Казак Ю.Ю.
Доктор філософії, старший викладач
кафедри теорії та практики іноземних мов
Уманський державний педагогічний університет імені Павла Тичини
Україна, Черкаська область, м. Умань, вул. Садова, 2

Abstract
The article deals with the problem of forming the lexical competence of students of higher education in pedagogical institutions of higher education at the German language lessons. The effectiveness of methods of teaching lexical units is substantiated, possible ways of assimilating new lexical material by future teachers of the German language with its active usage in speech activity are presented.

Анотація
Стаття присвячена проблемі формування лексичної компетентності здобувачів вищої освіти педагогічних закладів вищої освіти на заняттях із німецької мови. Обґрунтовано ефективність методів навчання лексичних одиниць, представлено можливі шляхи засвоєння майбутніми учителями німецької мови нового лексичного матеріалу з його активним використанням у мовленнєвій діяльності.

Keywords: lexical competence, future teachers of the German language, lexical units, education applicant, motivation, foreign language educational trajectory, institution of higher education.
Ключові слова: лексична компетентність, майбутні учителі німецької мови, лексичні одиниці, здобувачі освіти, мотивація, іншомовна освітня траєкторія, заклад вищої освіти.

Проблема формування лексичної компетентності здобувачів вищої освіти не є новою у методичних студіях України та зарубіжжя. На наш погляд, цей напрям потребує посиленої уваги науковців на сучасному етапі розбудови системи освіти України, оскільки важливим є переосмислення підходів до її формування з урахуванням рівня володіння іноземною мовою на різних етапах навчання. Предметом нашого дослідження є пошук ефективних стратегій навчання лексики здобувачів вищої освіти, які розпочинають вивчення другої іноземної мови (німецької), оскільки це уможливить здійснення відбору дієвих методів для формування індивідуальних іншомовних освітніх траєкторій педагогічними закладами вищої освіти України.

Мета статті – обґрунтувати ефективність методів навчання лексичного матеріалу здобувачів вищої освіти на практичних заняттях із німецької мови, які розпочинають її вивчення.

Формування лексичної компетентності є одним із ключових способів опанування іноземної мови: у процесі слухання об'ємний словниковий запас допомагає отримувати інформацію, в усному мовленні дає можливість чітко висловлювати власні думки, а під час читання допомагає здобувачам легко розуміти текст. Застосування ефективних методів навчання лексики суттєвою мірою полегшує процес опанування іноземної мови. Дослідники A. Herrel та B. Henrikson [2, 3] пропонують наступні: розуміння з опорою на контекст, вивчення спільнокореневих слів, ведення словника, контекстуалізація, маркування, персоналізація, асоціація, категоризація слів, семантичне відображення тощо. Під час навчання лексики викладачеві необхідно враховувати індивідуальні особливості групи та рівень володіння іноземною мовою. На початковому етапі легше оволодіти німецькою мовою за допомогою лексичних ігор, натомість підвищення рівня знань зумовлює активізацію абстрактного мислення.

Із метою реалізації поставленої мети дослідження викладач – його автор – та 16 здобувачів вищої освіти освітньо-професійної програми «Середня освіта (Мова і література (англійська, німецька))» в рамках реалізації практичної складової обов'язкової освітньої компоненти «Методика навчання другої іноземної мови (німецької)» провели експеримент, який включав теоретичну та практичну частини. Його результати ми спробуємо висвітлити у нашій статті.

Реалізація теоретичної складової відбувалася на лекційних та практичних заняттях освітнього компоненту «Методика навчання другої іноземної мови (німецької)», яка є дисципліною обов'язкового циклу освітньої програми «Середня освіта

(Мова і література (англійська, німецька))», а її вивчення – власним волевиявленням, зумовленим вибором цієї освітньо-професійної програми. Практична складова дослідження передбачала опитування здобувачів вищої освіти, а також спостереження й анкетування ними учнів під час проходження виробничої педагогічної практики. Для забезпечення об'єктивності майбутні вчителі німецької мови були повідомлені про його анонімність і про те, що їхні коментарі жодним чином не вплинуть на ставлення викладача до них.

Опитування здобувачів вищої освіти розпочалося із питання: «Чи достатньо Вам практичних занять для покращення рівня володіння другої іноземної мови (німецької)?» Як видно із рис. 1, 69% здобувачів вищої освіти висловилися позитивно. Протилежну точку зору мають 31%.

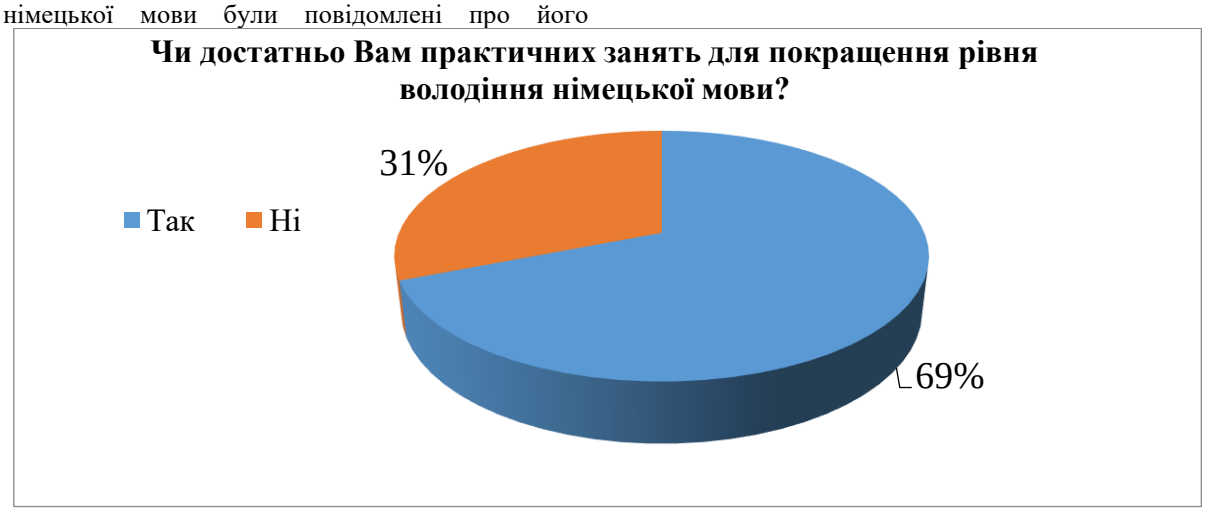


Рис. 1. Візуалізація відповідей на перше дослідницьке запитання

Наступне дослідницьке запитання стосувалося виявлення інтересу до викладання майбутніми вчителями другої іноземної мови. Більшість респондентів висловилися позитивно, а саме 56% (Рис. 2). Безсумнівно, саме інтерес допомагає здобувачеві вищої освіти проявляти ініціативу в освітньому процесі.

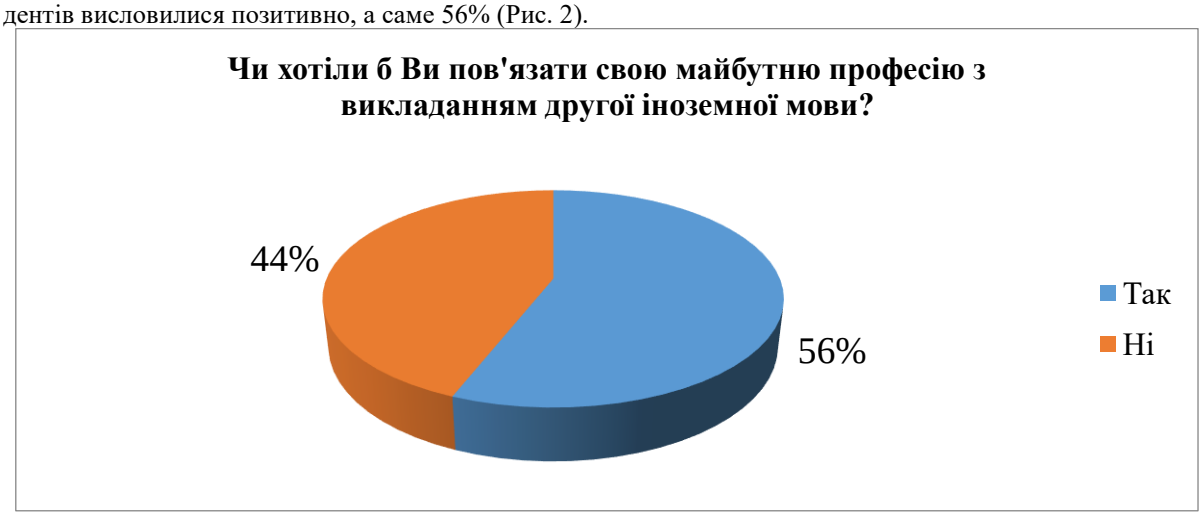


Рис. 2. Візуалізація відповідей на друге дослідницьке запитання

Як видно з рис. 3, більше половини опитаних (62,5%) мають мету – володіти німецькою мовою на належному рівні. Коли здобувачі вмотивовані, вони проявлятимуть інтерес та позитивне ставлення до навчання. Учасники, які не мають мотивації до вивчення іноземної мови, на всі питання анкети відповідали неохоче (18,7%). Для двох учасників (12,5%) бажання володіти німецькою мовою підкріплене бажанням відвідати німецькомовні країни. Один учасник зазначив (6,3%): «Німецька мова дозволить мені стати конкурентоспроможним».

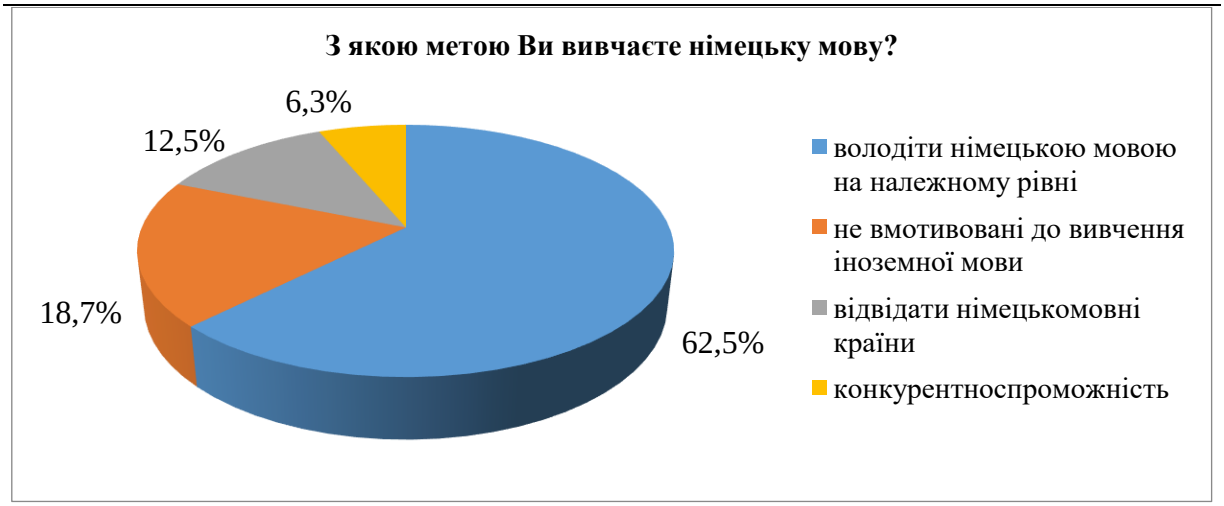


Рис. 3. Візуалізація відповідей на третє дослідницьке запитання

Звернемося до опису результатів анкетування учнів, проведене на наше прохання здобувачами вищої освіти під час проходження виробничої педагогічної практики у закладах загальної середньої освіти. Варто зазначити, що школярі були попереджені заздалегідь про його анонімність. Для реалізації цього етапу дослідження 24 його учасники були розподілені на 2 підгрупи, по 12 осіб у кожній.

Учасникам обох груп було запропоновано заповнити анкети для визначення рівня їхнього інтересу до вивчення німецької мови (табл. 1).

Таблиця 1

Мотивація учнів до вивчення німецької мови

Запитання	Відповіді	Кількісні показники	%
1. Чи цікаві тобі уроки з німецької мови?	• Дуже цікаві • Цікаві • Не дуже цікаві • Нудні	11 6 5 2	46 25 21 8
2. Що тобі подобається робити на уроках з німецької мови?	• Працювати з іншомовними текстами • Виконувати граматичні вправи • Вчити нову лексику • Займатися в групах • Вчити тексти та діалоги	4 6 4 8 2	16 25 16 33 10
3. Чи легко тобі долати мовний бар'єр?	• Так • Ні	15 9	63 37
4. Чи приносить тобі користь вивчення німецької мови?	• Так • Ні	20 4	83 17

Проаналізувавши результати анкетування, варто зазначити, що певна частина респондентів виявляють низький рівень інтересу до вивчення німецької мови (29%) та вважають процес вивчення нових слів нецікавим. Деяка частина учнів мають страх спілкування німецькою мовою через брак словникового запасу (37%). Проте переважна більшість здобувачів освіти (71%) із високим рівнем мотивації до вивчення мови, вони наполегливі, старанно навчаються та демонструють високі результати на заняттях.

Не менш важливим було визначення кола методів, які допомагають учням в опануванні нової лексики до початку експерименту та які з них вони вважають ефективними (табл. 2).

Таблиця 2

Перелік методів навчання лексики

Які методи навчання лексики найчастіше застосовує вчитель на уроках із німецької мови?	• Вивчення слів у процесі читання та слухання. • Вивчення лексики за допомогою укладання списків слів. • Вивчення слів у контексті. • Вивчення слів під час читання книг. • Вивчення слів шляхом їх написання. • Вивчення лексики шляхом словникових ігор. • Вивчення слів крізь призму пісень. • Перегляд фільмів німецькою мовою. • Навчання шляхом вивчення синонімів та антонімів. • Навчання за методом граматичного перекладу.
Які методи навчання лексики ти вважаєш цікавими?	• Навчання на основі читання та слухання. • Вивчення лексики шляхом укладання списків слів. • Вивчення слів на основі контексту. • Навчання за допомогою читання книги. • Вивчення слів шляхом тренування правопису. • Вивчення лексики на основі словникових ігор. • Вивчення слів на основі пісень. • Навчання під час перегляду фільмів німецькою мовою. • Навчання шляхом вивчення синонімів та антонімів. • Навчання на основі методу граматичного перекладу.

За результатами анкетування більшість учасників (75%) стверджують, що вони вивчають лексику, укладаючи списки слів, вивчаючи їх правопис та шляхом прослуховування. Лише шість учнів (25%) зазначають, що вивчають нові слова, дивлячись фільми та читаючи книги у вільний час. Найцікавішими методами навчання лексики для переважної більшості опитаних (83%) є вивчення лексики за словниковими картками та під час перегляду фільмів. Анкета була розроблена з метою вибору ефективних методів навчання лексики здобувачів освіти, які використовувалися під час занять у фокус-групі.

Наступним кроком дослідження було виконання тестових завдань для визначення рівня володіння німецькою мовою. Тестові завдання були розроблені після двох тижнів навчання лексики на базі традиційних методів для визначення рівня їхньої ефективності в освітньому процесі. Попереднє тестування включало завдання на встановлення відповідності, заповнення пропусків, запитання із множинним варіантом відповіді, запитання на визначення правильності та передбачало роботу зі словником. Для перевірки використовувалися роздаткові матеріали, які представлені в таблиці (табл. 3). Всі учасники виконували завдання самостійно.

Таблиця 3

Перевірка знань слів

Слово	Не пам’ятаю	Погано пам’ятаю	Переклад/ пояснення	Використання у реченні
Забруднення				
Сміття				
Навколишнє середовище				

Активну участь в експерименті взяли здобувачі освіти фокусної та контрольної груп. Спочатку результати виконання завдань були ідентичні. Наступна частина базувалася на практичній роботі у класі. Вона включала проведення занять на одну й ту саму тему, під час яких застосовувались різні методи навчання лексики, з подальшим тестуванням та оцінюванням результатів в кожній з них. Дослідницька робота розпочалася з контрольної групи, застосовувалися такі методи навчання лексики, як: вивчення слів, навчання читання й аудіювання, навчання за словниковими картками, вивчення лексики шляхом укладання списків слів.

Під час експерименту з фокус-групою використовувалися методи вивчення лексики на основі поділу слів на 3 групи: форма, вживання та значення. Після закінчення дослідження було проведено тестування, яке мало на меті перевірити ефективність застосування означених методів. Після проведення дослідження тест був еквівалентним тому, що був запропонований перед початком експерименту. Він включав завдання на заповнення пропусків, запитання із множинним варіантом відповіді та визначення правильності тверджень.



Рис. 4. Візуалізація результатів анкетування

Як видно із рис. 4, лише семеро учнів (29%) вважають запропоновані слова легкими. Ця невелика частина респондентів має кращий рівень володіння мовою, ніж решта. Кількість опитаних, які вважають запропоновані слова помірної складності, становить 8 осіб (33%). Вони мають достатньо широкий словниковий запас. Протягом експерименту проводився моніторинг рівня знань слів і готовності їх вивчати. Саме словниковий запас та активне його використання в усному та писемному мовленні допомагає об'єктивно оцінити рівень знань здобувачів освіти.

Завершальним етапом експериментального дослідження був розрахунок та аналіз зібраних даних, на основі яких було зроблено висновки та перевірено, чи всі поставлені цілі були реалізовані. Результати повторного анкетування продемонстрували позитивні зрушення у фокус-групі (+32,5%) та незначні у контрольній (+12%). На основі отриманих даних можна зробити висновок, що використання ефективних методів навчання лексики має позитивний вплив на процес опанування німецької мови, адже потреба у поповненні словникового запасу є істотною, оскільки це природне явище протягом всього життя, це постійний процес зустрічі з новими словами.

Після детального вивчення дослідницьких запитань було виявлено, що методи навчання, які надають лише дефінітивну інформацію про кожне слово, яке потрібно вивчити, або які передбачають багаторазове повторення інформації, що вивчається, не мають суттєвого впливу на поповнення словникового запасу. Вивчення лексики складніше, ніж просте запам'ятовування слів. Розділяємо думку дослідників K. Flanagan і S. Greenwood щодо дотримання викладачами чотирьох факторів при виборі методів навчання лексики: 1) учасники освітнього процесу, яких вони навчають; 2) характер слів, яких вони навчають; 3) цілі у навчанні цих слів; 4) методи для вивчення слів [1].

Важливо пам'ятати про загальний принцип, який полегшує засвоєння нової лексики: здобувачі освіти повинні мати можливість вивчати нові слова, використовуючи різноманітні методи та форми навчання, які активно залучать їх до освітнього процесу. Сподіваємося, що використання вищезазначених методів допоможе здобувачам освіти стати вербофілами – «людьми, які люблять вивчати слова та стають ентузіастами мови, любителями слів, читачами, які знають слова» [4]. Наші дослідження в цій сфері все ще тривають і в повній мірі підтверджують запропоновану гіпотезу.

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PHILOLOGICAL SCIENCES

THE GREAT MYSTERY: CHARLES DICKENS' NOVEL «THE MYSTERY OF EDWIN DROOD» IN LITERARY CRITICISM AND ATTEMPTS TO COMPLETE IT

Chechetko M.V.,
Candidate of Philological Sciences, Associate Professor
Makhambet Utemisov West Kazakhstan University
Kazakhstan, 090000, Uralsk, Nursultan Nazarbayev Avenue, 162
Frolov I.M.
Master of Science, Lecturer
Makhambet Utemisov West Kazakhstan University
Kazakhstan, 090000, Uralsk, Nursultan Nazarbayev Avenue, 162
DOI: 10.5281/zenodo.7994835

ВЕЛИКАЯ ЗАГАДКА: РОМАН ЧАРЛЬЗА ДИККЕНСА «ТАЙНА ЭДВИНА ДРУДА» В ЛИТЕРАТУРНОЙ КРИТИКЕ И В ПОПЫТКАХ ЕГО ЗАВЕРШЕНИЯ

Чечётко М.В.,
Кандидат филологических наук, доцент
Западно-Казахстанский университет имени Махамбета Утемисова
Казахстан, 090000, Уральск, проспект Нурсултана Назарбаева, 162
Фролов И.М.
Магистр наук, преподаватель
Западно-Казахстанский университет имени Махамбета Утемисова
Казахстан, 090000, Уральск, проспект Нурсултана Назарбаева, 162

Abstract
This article provides an overview of the history of the question of the unfinished novel «The Mystery of Edwin Drood» by Charles Dickens, the critical reviews of the novel, and attempts to complete it.
Аннотация
В данной статье даётся обзор истории вопроса незаконченности романа «Тайна Эдвина Друда» классика английской литературы Чарльза Диккенса, критических отзывов о романе и попыток его завершения.

Keywords: Charles Dickens, The Mystery of Edwin Drood, novel, classic, literature, completion, criticism, analysis, research
Ключевые слова: Чарльз Диккенс, Тайна Эдвина Друда, роман, классика, литература, завершение, критика, анализ, исследование

Чарльз Диккенс принадлежит к тем великим писателям, мировая слава которых утвердилась непосредственно с появлением их первых произведений. Не только в самой Англии, но и в Германии, Франции, России вскоре после выхода в свет первых книг Боза (псевдоним молодого Диккенса) заговорили об авторе «Пиквикского клуба», «Оливера Твиста» и «Николаса Никльби». В России книги Диккенса были оценены по достоинству очень рано и в начале 40-х годов XIX века систематически и многократно печатались на страницах литературных журналов и выходили отдельными изданиями. Интерес к каждому произведению Диккенса давно и прочно утвердился в литературной критике разных стран и каждое из них окружено целой системой трактовок, комментариев и критических прочтений. Но одно из них занимает особенное место в этом литературно-критическом ряду и вызывает особого рода интерес. Это - роман «Тайна Эдвина Друда» (1870).

Чарльз Диккенс открыл своим творчеством новый этап в истории английского реализма. Его творческий метод соединил в себе предшествующие достижения реализма XVIII века и художественный опыт романтической поэтики. Он утвердил своим творчеством жанр социально-психологического романа - романа о герое и обществе, где ставились острые социальные проблемы и в то же время создавались яркие, запоминающиеся образы. Писатель создал Диккенсиану - неповторимый художественный мир, отмеченный особым поэтическим единством, оригинальностью его творческого стиля. Он известен как создатель «рождественской миссии» - особой утопической идеи, связанной с образом английского Рождества как праздника всеобщего единения и гармонии в обществе. На этом творческие открытия Диккенса не завершаются: он является одним из первых писателей в мировой литературе, взявшихся за разработку нового детективного жанра. Вклад в эту область Чарльза Диккенса значителен и несомненен. Его последний роман «Тайна Эдвина Друда» в литературном общественном мнении и критике традиционно считается детективным.

«Неоконченный детективный роман — это не просто неоконченный роман, - замечает автор одной из самых содержательных книг о творчестве Диккенса Т.И. Сильман. - Сюжет здесь не только не получает своего логического завершения, но лишен сердцевины, существа - разгадки. В то же время «Тайна Эдвина Друда» - одно из самых замечательных произведений Диккенса по глубине психологического анализа». Действительно, последний роман Диккенса отражает характерный для писателя в конце его творческого пути интерес к глубинам человеческой психики, порою даже болезненным и необычным ее проявлениям. Но тот огромный интерес, который проявляют читатели, и критика к этому роману объясняется, конечно, первым обстоятельством - чудесной, истинно диккенсовской, детективной загадкой, волею судьбы оставшейся неразгаданной. И та, и другая особенности романа взаимно усиливают друг друга. Интерес Диккенса к необыкновенному и болезненному достиг в этом романе особой остроты. Детективная загадка поставлена, но не разгадана. «Тайна Эдвина Друда» в большей мере, чем какой-либо другой диккенсовский роман, отвечает всем требованиям увлекательного чтения.

История создания романа относится к последним годам жизни и писательской деятельности Диккенса. Первые наброски его были сделаны в июле 1869 года. Первоначальный замысел сводился к любовной интриге на фоне традиционной борьбы за наследство. Роман был задуман как рассказ о душевном конфликте Розы Бад (Бутон) и Эдвина Друда, двух молодых людей, предназначенных друг для друга «по завещанию» их родителей, но не любящих друг друга и избравших различные пути в жизни. Но вскоре, уже в августе 1869 года, план книги осложнился. Первоначальный замысел обогатился множеством дополнительных мотивов, которые в конце концов из второстепенных стали главными. Развитие криминальных мотивов увлекло писателя. Идея романа - убийство дядей своего племянника, убийства, причины которого должны оставаться неясными, - казалась Диккенсу заманчивой - как своей сенсационностью, так и возможностью развития богатой событиями и запутанной интриги. Это и определило особую стилистическую стихию романа.

Весь роман проникнут ощущением неизбежности преступления. Предчувствия, предсказания, соответствие картин и состояний природы - мрачные переживания героев, необыкновенные ситуации, вызывающие в памяти сюжеты готического романа «ужасов и тайн» и страницы предыдущих романов самого Диккенса, где встречалось немало «страшных» мотивов и обстоятельств, - всё здесь налицо и всё вместе с тем как-то по-новому сюжетно и стилистически организовано. Образная стихия романа необычна и впечатляюща: в нем ощущается зрелое мастерство Диккенса, взявшегося за новую для себя художественную задачу - создание детективного романа.

Чарльз Диккенс скоропостижно скончался девятого июня 1870 года, в разгар работы над романом. Восьмого июня он, не отрываясь, просидел над рукописью романа, посвятив работе весь день, словно предчувствуя краткость оставшегося ему срока работы над ним. Роман «Тайна Эдвина Друда» оборвался на двадцать третьей главе. Предполагалось, что роман выйдет в двенадцати ежемесячных выпусках. К моменту смерти Диккенса было опубликовано три выпуска, еще три были оставлены в рукописях, приготовленных к публикации, и напечатаны сразу после смерти писателя. Тут роман и оборвался. Сверх этого, не удалось найти ни одной строчки, ни одной заметки - кроме краткого чернового наброска одной главы, которую Диккенс решил не включать в окончательный текст романа. Автор унес свою тайну в могилу, лишь наполовину написав свое произведение.

На протяжении более чем ста пятидесяти лет, прошедших со времени создания романа, критики, литературоведы и читатели бьются над его разгадкой. Они строят предположения и составляют логические системы относительно того, кто убил героя романа Эдвина Друда и был ли он действительно убит, кто такой таинственный мистер Дик Дэтчери, внезапно появившийся в Клойстергеме, - городе, где разворачиваются события романа в большей своей части. Чарльз Диккенс словно подарил своим читателям уникальный художественный ребус, который разгадывает уже не одно поколение. Для его разгадки естественно требуется изучить в мельчайших деталях и подробностях дошедший до нас текст романа, проследить в нем истинные и ложные «ключи» к разгадке.

Гипотез существует множество, что говорит о популярности романа. Интерес к роману вызван и тем, что это последнее и к тому же незавершенное произведение Диккенса, и тем, что это роман событийный, фабульный и достаточно запутанный, к чему Диккенс имеет прямое отношение, введя в текст романа мотивы, ведущие к различным поворотам сюжета. Этим и обусловлено немалое число существующих гипотез. Роман словно побуждает читателей ждать, а литераторов - создавать продолжения, подобно некоторым другим книгам такого рода - романам Джейн Остен, «Джен Эйр» Шарлотты Бронте, «Айвенго» Вальтера Скотта или романа Маргарет Митчелл «Унесённые ветром». Это книги особого рода, продолжающие жить в воображении читателей особым образом - несмотря на различие их творческой судьбы. И если романы Остен, Бронте, Скотта и Митчелл - завершены, и читатель ждет от «продолжений» дальнейшего развития событий после уже рассказанной автором истории, то продолжение «Тайны Эдвина Друда» затруднено тем, что в бумагах Диккенса не осталось никаких набросков и планов, позволяющих судить о том, как автор намеревался завершить свою не рассказанную до конца историю. Попытки установить это и завершить роман породили целую литературу вокруг него, окружив его особым критико-литературным ореолом.

Однако, роман вызывает и вполне традиционный интерес литературоведов - как произведение Чарльза Диккенса, пусть и незавершенное, но созданное им в определенный период своей литературной деятельности, неотъемлемой части его литературного наследия. В истории литературы прочно утвердилась периодизация творчества Диккенса, разделяющая его литературную деятельность и произведения на четыре периода. Периодизация творчества Диккенса основана на том, что его общественные, политические, этические взгляды и воззрения стремительно эволюционировали и менялись на протяжении его жизни. Соответственно менялся и его взгляд на реальность и отражение её в его книгах. «Тайна Эдвина Друда» относится к четвертому периоду творчества писателя, когда художественная ориентация его творчества изменилась и после грандиозных социальных романов 50-х годов он обратился к сенсационным, психологическим, криминальным темам. Подход к тому, что воплотилось в тематике и проблематике «Тайны Эдвина Друда» ощущается в предыдущих его книгах - романах «Большие надежды» (1861) и «Наш общий друг» (1865), а также в повестях и рассказах этого периода.

О творчестве Чарльза Диккенса существует такое множество работ, что в англо-американской истории литературы по ним созданы специальные путеводители, справочники, библиографические указатели и диккенсовские энциклопедии. Обзор этого безбрежного книжного моря занял бы многие страницы, даже если свести его к перечислению лишь основных работ о творчестве писателя. Следует ограничиться лишь данным романом, взятым для анализа, что сразу же сужает крут критических работ. Но даже и такой обзор может быть только выборочным, связанным с проблематикой данной статьи.

Все тридцать пять лет своей литературной деятельности Диккенс пользовался вниманием критики: он сразу же после выхода первых книг стал знаменитым писателем и оставался таковым при жизни. Он стал легендой, мифом викторианской Англии, бесспорно первым по значению писателем. Переоценка его творчества началась в 80-е годы XIX века в связи с появившимися работами позитивистской критики, в частности, работами Генри Льюиса, где содержались сомнения в бесспорности его литературного авторитета. На рубеже XIX-XX веков творчество Диккенса подвергалось критике со стороны литературной группы Блумсбери - кружка писательницы Вирджинии Вульф: они не находили в нем глубины, подтекста, тонкого психологизма, считая его лишком простым и открытым, рассчитанным на молодого, наивного читателя. Англия довольно скромно отметила его столетие в 1912 году.

В 20-30-е годы XX века интерес к Диккенсу стал быстро возрастать. Вышло много биографических работ, содержавших новые, не известные до той поры материалы. В 1938 году вышло четырехтомное собрание его переписки, в 40-е годы появились работы, в которых раскрывалось мастерство Диккенса, богатство его фантазии, умение трансформировать реальность и создавать обобщенные образы большой художественной силы. В 50-60- е годы число работ о Диккенсе увеличивалось стремительно, и проблематика их расширилась. В 1962 году Англия торжественно отметила 150-летие со дня его рождения; в 1965 году стало выходить четырнадцатитомное собрание его сочинений. В 1970 году отмечали столетие со дня его смерти. Юбилейные материалы, конференции и новые работы выходили и организовывались ежегодно; вышло новое, текстологически выверенное собрание его сочинений под редакцией специалистов по его творчеству К.Тиллотсона и Дж.Батта. Теле- и радиопередачи, спектакли, выставки, заседания мемориального диккенсовского общества составили то, что называют в Англии «диккенсовской индустрией»: выпуск его книг и книг о нем, пособий, альбомов, проведение семинаров и научных дискуссий по его творчеству, защита диссертаций, экранизация и театральные постановки его произведений сделали его своеобразным национальным институтом, так же как Уильяма Шекспира.

В огромном количестве работ о Диккенсе его последний роман фигурировал не столь уж часто: основное внимание уделялось другим его произведениям. Это было связано ещё и с тем, что стали особенно популярными работы о комическом искусстве Диккенса, а этот роман, если не считать нескольких эпизодов, не давал материала для такого анализа. Такого рода работы - исследования А.Бейкера, Р.Гариса, У.Экстона, С.Мэннинг, М.Китзина - выходили особенно часто в 60-70-е годы. Авторы этих работ искали в писателе своеобразного драматурга, мастера создавать нечто вроде «театра в романе», а также мастера использовать фольклорные, сказочные мотивы. Всё это не касалось прямо романа «Тайна Эдвина Друда», поэтому более часто и полно анализировались другие произведения Диккенса.

Но роман значительно чаще фигурировал в работах иного рода. Эти исследования связаны с историей классического детектива в англо-американской и европейской литературной традиции. В известных исторических обзорах детективного жанра - книгах «Развитие детективного романа» (1958) Э.Мерч, «Гнусное убийство. От детективного рассказа к полицейскому роману» (1972) Дж.Саймонса, «Небесные ищейки. Детектив в английской прозе от Годвина до Конан Дойля» (1976) И.Огсби - Чарльзу Диккенсу и его последнему роману неизменно отводится отдельная глава. Однако, анализ «Тайны Эдвина Друда» производится преимущественно в плане содержательно-тематическом, с привлечением обзора наиболее известных гипотез. Собственно, анализ стиля в широком смысле этого слова не производится; образная система романа и его художественная стихия не исследуются.

Точно так же производится разбор романа в специальных работах о роли и месте детектива в творчестве Диккенса, наиболее интересная из которых - работа Филипа Коллинза «Диккенс и преступление» (1962). В работе подробно рассматривается

роль криминальной темы в творчестве Чарльза Диккенса, во всех ее частных проявлениях и деталях: тема тюрьмы, суда, следствия, работы полиции и сыщиков, смертной казни, раскаяния и разного рода преступлений. Книга предлагает тщательный анализ произведений Диккенса на тематическом уровне - с прослеживанием всех поименованных проблем и сюжетных мотивов. В книге есть глава, полностью посвященная анализу романа «Тайна Эдвина Друда»: эта глава, заключающая книгу, как бы венчает криминальные поиски Диккенса, вылившиеся наконец в отдельное произведение, уже целиком построенное по законам и канонам детектива. Эволюция криминальной темы у Диккенса дана в работе достаточно полно и убедительно, но анализ романа «Тайна Эдвина Друда» предлагается односторонне - лишь в плане его криминальной тематики.

В России творчество Диккенса всегда высоко ценилось и книги его издавались и были популярны у широкого читателя. Впервые его перевод был напечатан в журнале «Сын Отечества» в 1888 году; первый перевод романа в журнале «Библиотека для чтения» в 1840 году. О Диккенсе писали в своих работах В.Г.Белинский и И.Г.Чернышевский, Лев Толстой назвал его одним из любимейших им писателей. Переводы Диккенса, сделанные Иринархом Введенским, знаменитым переводчиком писателя, были талантливы, и публика полюбила книги Диккенса. Ему безоговорочно отводили одно из первых мест в ряду зарубежных писателей.

В советском литературоведении Чарльз Диккенс также оценивался неизменно высоко. Его много издавали и читали. В 1957-1963 годах было издано тридцатитомное собрание сочинений писателя - на основе первого издания собрания его сочинений в Англии, в 1881 году также в тридцати томах. О Диккенсе писали крупнейшие ученые и исследователи - А.А.Елистратова, В.В.Ивашева, Н.П.Михальская, З.Т.Гражданская. Вышла работа И.Катарского «Диккенс в России. Середина XIX века», содержащая много ценных материалов о судьбе книг писателя в России. Одной из самых ценных и интересных работ о писателе была уже упомянутая ранее работа Т.И.Сильман «Диккенс. Очерки творчества» (1970). Наибольшее внимание в этих трудах уделялось социальной стороне творчества Диккенса, его сатире и критике современного ему общества. Значительно менее писали о фантазии Диккенса, театральных приемах в его творческой манере, гротеске и юморе, о его «рождественской миссии», а также и о криминальной теме в его книгах и его роли в создании жанра детектива. В свою очередь авторы специальных работ о детективе, вначале немногочисленных, обходили опыт Диккенса стороной. В одной из первых работ такого рода - истории детектива, написанной известным писателем этого жанра Аркадием Адамовым – «Мой любимый жанр - детектив. Заметки писателя» (1980) в качестве создателей и основателей жанра фигурируют Э.А.По и А.Конан Дойль, но о вкладе в него Диккенса ничего не говорится.

Таким образом, роман не получил целостного анализа в различных работах, хотя о нем написано немало. Однако, этот анализ разбросан по многим работам с различными исследовательскими целями. Проблема его целостного и полного анализа продолжает оставаться перспективной.

Попытки завершения романа следует выделить в отдельную группу книг: они также имеют свою историко-литературную основу. Это работы, посвященные исключительно детективной загадке романа и предлагающие свою точку зрения на нее и ее разгадку. Первой из них была знаменитая работа Джона Проктора «Мертвец выслеживает» (1887), в которой впервые ставилось под сомнение то, что герой романа был действительно убит. Эта же точка зрения легла в основу другой работы – «Загадка последнего сюжета Диккенса» (1905) Эндрю Лэнга. Эту точку зрения пытался опровергнуть Дж.Каминг Уолтерс в работе «Ключи к тайне Эдвина Друда» (1911). Далее гипотезы и версии множились и между авторами их началась полемика, в которой можно теперь выделить несколько точек зрения, каждая из которых поддерживается определенным кругом исследователей.

В советском литературоведении некоторое время попыток разгадки тайны не предпринималось. При издании тридцатитомного собрания сочинений Диккенса, в 27 томе, где был напечатан роман «Тайна Эдвина Друда», издатели поместили главу из работы Дж.Каминг Уолтерса (М., «Худ.лит.», 1962), приняв его версию в качестве наиболее убедительной. Ее оспорила Т.И.Сильман в своей книге о Диккенсе (1970). Однако, когда создавался советский телефильм по роману в 70-х годах, авторы фильма опять-таки склонились к версии Дж.К.Уолтерса.

В 1990 году под редакцией Е.Ю.Гениевой вышла книга «Тайна Чарльза Диккенса», включавшая в себя несколько статей по теме разгадки и истории создания «Тайны Эдвина Друда». В нее вошли статьи И.Смаржевской «Кто такой мистер Дэтчери» и А.Аникста «Кто убил Эдвина Друда», в которых предлагались новые версии к разгадке романа. В 1993 году в журнале «Филологические науки» (№2) была опубликована статья И.Коначевой «Художественная деталь, сюжет и реконструкция незаконченного романа Чарльза Диккенса», предлагавшая еще одну версию. Таким образом, можно отметить, что попытки разгадать сюжет последнего романа Диккенса значительно оживились в последние десятилетия и вряд ли до конца исчерпаны. Вероятно, будут предприняты и новые попытки его разгадки.

Всё вышеизложенное показывает, что роман «Тайна Эдвина Друда» представляет и по сей день несомненный интерес для анализа. Его стилистические особенности исследованы явно недостаточно. Роман достаточно сложен и в нем, во всяком случае, в той части, которую успел написать Диккенс, содержится некий парадокс: всё в книге сосредоточено, как и положено в детективе, на тайне преступления, но в то же время внимание автора занимает в значительной мере тайна человеческой души, сознание и подсознание. Расследование, которое, по

всей вероятности, должно было составить содержание второй, неизвестной, части - не может не включать в себя и исследования глубинных тайн человеческой психики: не только само преступление, но и психологические причины его занимают Диккенса. Подполье человека, ночной мир его существования, двойственность его природы, роль иррационального в его поведении - таковы проблемы, которые осмысливает писатель в «Тайне Эдвина Друда». В этом смысле Джон Джаспер, «злодей» романа - новый герой для Диккенса: человек яркий, одаренный, музыкант, артист, личность волевая и страстная, он при этом и личность патологическая, наркоман с болезненными отклонениями в психике, человек способный долго и хладнокровно готовить и совершить убийство. Этот герой предвосхищает героев Оскара Уайльда и многих героев английской литературы XX века; тема соотношения искусства, таланта и морали становится, начиная с пьесы Бернарда Шоу «Дилемма врача», одной из самых популярных в ней. Весь образный строй романа необычен: в мире, который описывает Диккенс, всё зыбко и ненадежно; смерть находится где-то рядом - недаром такую большую роль в повествовании играют кладбище и могильщик Дёрдлс, вызывающий в памяти могильщиков шекспировского «Гамлета». Можно предположить, что «Тайна Эдвина Друда» - произведение, которое готовило новый этап в творчестве Диккенса и всей английской литературы того времени.

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SOME ASPECTS OF THE DYNAMICS OF THE PROCESS OF FOREIGN LANGUAGE LEARNING

Kostadinov O.D.
Ph.D.,
Nikola Vaptsarov Naval Academy
Varna, Bulgaria
ORCID ID: 0000-0002-9183-5243
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Abstract

The acquisition of a foreign language is a lengthy process. Learned foreign words go into memory, but later the learners may forget them or, after repetition for varying lengths of time, they can memorize them. Forgetting foreign words has two degrees: forgetting the foreign words and their meaning in the native language or forgetting only the meaning of the foreign words in the native language. Learners must learn the forgotten foreign words again, like unknown words. Foreign language learners use only part of the learned words actively through speaking or writing, but there are words that learners can only understand when they listen or read. This division is the basis of the division of memory into active and passive. This publication examines the dynamics of the process of foreign language learning.

Keywords: process of foreign language learning; passive and active vocabulary; human reason and memory; memorizing of foreign language words; second-language attrition; language retention; model of how foreign languages work in the human mind

Research in Support of Modern Foreign Language Learning

1. Introduction

Mastering foreign languages has always been an intriguing issue. This issue is covered in a lot of linguistics articles. Although numerous methodologies for learning foreign languages have been developed, there is still more to discover. The two key issues that philologists are continuously concerned with are the effective learning of foreign languages and overcoming the negative effects of losing language knowledge.

Learning a foreign language is a challenging and creative process. The need to master various skills necessary for language proficiency causes the challenge. Children learn to read and write as they begin school, but they begin to understand and speak their native language at a very young age. On the contrary, when humans learn a second language, these activities can go on at the same time.

Finding the ideal balance between the development of fundamental language skills—listening and reading with comprehension, as well as speaking and writing in a foreign language—is necessary for success in language acquisition.

It is debatable whether simultaneous development of all skills and which teaching techniques are the most practical ways to learn a foreign language. Responses to these questions include how we can develop all skills and which teaching techniques are the most practical ways to learn a foreign language. Before addressing this issue, it is better to first consider the factors that influence foreign language acquisition.

There are numerous factors that influence language acquisition, and they can be divided into two categories: those that are helpful and those that are harmful.

The most effective method for learning a foreign language is the one that requires the least amount of effort. You can achieve the best outcomes by finding the right ratio of time spent speaking, listening, reading, and writing in a foreign language. This should also include a pleasant learning environment, which includes the use of audio-visual aids, educational materials, and a student's alert and unhurried frame of mind. Special consideration should be given to the circumstances that have a detrimental impact on learning, such as anything that makes learning too difficult or when learning advances at an inappropriate rate.

The two key issues with learning foreign languages are the inability to keep in memory the words learned and the challenge of communicating in a foreign language. Even when the student understands the other person very well, it may be difficult to respond in a foreign language. Also, there is a decline in language skills, even among people who have previously achieved language ability but do not continue to practice a foreign language.

2. Human mind components

Scientists are interested in the role of human minds since people have a constant desire to improve their intellectual skills. The ability of the human intellect is extensive. The ability for thought and analysis belongs to the human mind. There are some theories that explain how the mind works. Some psychologists believe that the mind's essential components are only the "highest" intellectual processes, like reason and memory.

Memory and reasoning serve complementary functions. Memory serves to maintain access to previously acquired information (including information recently generated in the course of a task) while reasoning seeks to derive new information from the old. [1]

3. Passive and Active vocabulary

There are two types of vocabulary: active and passive. Humans' active vocabulary is the one that is used in both their private and public lives on a regular basis. The higher the vocabulary, the more advanced the speaker's linguistic culture. Words that a person knows

and can understand to varied degrees but does not actively use when speaking are included in their passive vocabulary. The native language's vocabulary is always larger than that of other languages. The vocabulary of the foreign language may theoretically grow to be larger than that of the native language, but this shows that the foreign language has already supplanted the native language. This is possible for people who reside in a foreign nation and only speak the local language. [2]

Receptive and productive vocabulary are other names for passive and active words. Grammar and vocabulary are the fundamental building blocks of language. The time and effort needed to master these two fundamental concepts in a foreign language are the greatest. It is common knowledge that reading and listening comprehension in a foreign language are always simpler than speaking and writing. In addition, the words we use are far less typical than the ones we understand. Each of these things has an explanation, and it's crucial to recognize and comprehend this while developing strategies for learning other languages. [3]

Because of language learning and the natural deterioration of language if it is not consistently used, human active and passive vocabulary knowledge is continuously changing. People employ their regular vocabulary, pick up unfamiliar words and lose old ones, experiment with some updated terms, and learn about other people's vocabularies. Humans' active and passive vocabularies may easily switch words back and forth over time, but their passive vocabularies will always be much larger.

4. Prevention of attrition and promotion of retention

The loss of second-language ability, also referred to as "second-language attrition", happens whenever a learner uses the second language insufficiently. When learners reach fluency or competence, their language abilities typically begin to deteriorate because of a decrease in interaction with the second language, whether from a loss of communication with others or other factors. Foreign language attrition is the gradual decline in language ability, usually because of a decrease in language input and use.

Language retention, which should be defined as the deliberate participation in actions that will slow or impede attrition, is the reverse of language attrition. There are at least two components to retention: preserving or generating possibilities for both language input information and production. The latter refers to the anticipation of output that results from genuine interaction with others, not just the expression of utterances for practice. [4]

5. Author's thesis for Dynamic model of foreign language learning

The human mind has two basic faculties: reason and memory. Reason and memory have their own specific functions that complement each other. Physiologically healthy people have equally well-developed reason and memory. Greater deviations in either direction are more likely to represent some sort of disease state. Foreign language learning takes time and effort. There are various steps involved in understanding, learning, and using unfamiliar words. The repetition of previously forgotten words is a necessary part of learning a foreign language because of the human inclination to forget. Reason and memory are the two basic cognitive processes involved in learning a foreign language. These two mental functions of the human mind interact and support one another. Both skills are interdependent, meaning they complement each other. Reason takes the lead while learning foreign language grammar, and memory takes the lead when learning new vocabulary. Everyone has a vocabulary that is both passive and active, according to theory. This is governed by the memory's ability for storing passive and active language information, or, more specifically, by the distinction between the memory's ability for passively storing lexical objects and that for actively processing them.

My understanding is that the model of how foreign languages function in the human mind has four sectors that make interconnections.

The dynamic model of foreign language learning has the following interconnected sectors (fig. 1):

1. Senses: hearing and sight
2. Language skills: listening, reading, speaking, and writing
3. Reason
4. Memory

Each of the functional sectors has sub-sectors with specific duties. All functional sectors and subsectors interact.

		DYNAMIC MODEL OF FOREIGN LANGUAGE LEARNING			
skills		by listening	by reading	by speaking	by writing
reason		comprehension	comprehension	thinking	thinking
decode		translation	translation	translation	translation
time		for reception	for reception	for production	for production
memory	UPPER LAYER				
result	Active vocabulary	Foreign words that are well understood and actively used by the language learner			
	BASIC LAYER				
	Passive vocabulary	Foreign words that the language learner comprehends but cannot actively use			
	LOWER LAYER				
	Words for review	Foreign words that the learner studies but forgets the meanings in their native tongue			
	DEEP LAYER				
	Forgotten words	Foreign words that were learned but fully forgotten and need to be relearned			
			Author: Ognyan Kostadinov, https://orcid.org/0000-0002-9183-5243		

Fig. 1

5.1. Reception of unfamiliar foreign words by listening and reading

Obtaining information in a foreign language, also called "input information", is done through the sensory skills of hearing and vision. My understanding is that the first memorization of vocabulary depends primarily on attention and the duration of contact with the new and unfamiliar foreign words. Effective acquisition of new vocabulary requires that, when learning texts, they must be heard repeatedly with quality speech reproduced. After listening to the text twice, it is good to listen to it again, but at the same time, the students should visually follow the written text. It is recommended that texts that are studied within one lesson is good to have 3–4 unfamiliar foreign words that are repeated several times in the text. It is also recommended that learners go through the text at least three times without translating the unfamiliar words. The goal is first to memorize only the foreign word without its translation into the learner's native language. During this stage, the learner is expected to understand the meaning of the unfamiliar words from the context, i.e., reason is involved. After translating the word with a dictionary, the text must be read and translated again. It is recommended that after the translation of the text, the unfamiliar words be included in the grammar exercises for learners to hear other meanings of the words and to reinforce their memorization. It is advisable to give more time and attention to unfamiliar words in a foreign language when learning them for the first time. Attention and timing for the first acquisition of new vocabulary are crucial for the length of time foreign words remain in the learner's memory.

5.2. Memory and stages of foreign language memorization

According to the model, the memory is divided into four layers. The uppermost layer, the closest to the layer of the mind, is used for the active foreign language vocabulary. The active vocabulary is that which is used in speaking and writing. The active vocabulary reflects the level of proficiency in the language. The level of a foreign language's active vocabulary depends on the effort that is put into learning the language, but it also depends on the level of vocabulary mastered in the native language. The foreign language vocabulary cannot be richer than the native language vocabulary.

The passive foreign language vocabulary is in the second memory layer. This is the vocabulary of words that the foreign language learner understands when listening or reading but is unable to reproduce when speaking or writing. This layer of memory is the most dynamic because, in learning a foreign language, a part of the words in passive vocabulary go to the active vocabulary but could also go to the lower third layer of memory if they are not used.

The third layer of memory is the vocabulary of foreign words whose meaning in the native language is unknown. In this layer of memory are the words that are in the process of being assimilated and transferred to some of the upper layers of memory.

The fourth layer of memory is the "forgotten" foreign words, which have not completely disappeared from the deep memory. In fact, these are the words that are forgotten because they are not used. The recovery of "forgotten" foreign words is significantly easier than learning new unfamiliar foreign words.

5.3. Dynamics of the process of foreign language word memorization, attrition, and promotion of retention

The human mind has three properties that influence the rate of foreign language acquisition, retention, and loss. The capacity of memory, attrition, and retention of the learned vocabulary and grammar of the foreign language are what determine the dynamics of

learning a foreign language. After a foreign word is encountered and learned, it remains in active memory for a short time. Usually, the words pass to some of the lower layers of the foreign language's memory. Knowledge of a foreign language is both passive and active. The passive level is the lower one, and the vocabulary in it is the basic vocabulary. Passive vocabulary is upgraded during the time when the foreign language is learned. After frequent listening and reading of the words from the passive vocabulary, some of them pass into active memory. The words in active memory can go to passive memory when they are not frequently used.

Methods: Practical experience in learning foreign languages, theoretical knowledge, and descriptive method is applied by the author of the article.

Conclusion: The article pays special attention to the efficient acquisition and memory retention of the vocabulary of foreign languages, which are the main problems in their study. The author of the article believes that since nature has universally applicable laws and that man is a product of those laws, it is best to learn a foreign language in a natural way through listening comprehension. Practical results prove that the acquisition of a foreign language is easier with listening comprehension and constant review that is learned and kept permanently in the memory. The author's maxim is that foreign language learning should keep the foreign language alive through listening comprehension, reading comprehension, and communicating in person with native speakers.

Proposal for techniques and strategies for foreign language learning:

The strategies are based on following principals:

1. Vocabulary – to be used the word list of Oxford Learner's Dictionaries base on first list of 3000 words by CERF level and second list of 5000 words by CERF level which includes the first list words. [5]

2. The words of both lists are divided in 6 levels: A1, A2, B1, B2, C1, C2.

3. All lessons must be strictly based on currently studied list of words beginning with list of 3000 works, and later with list 5000 words and the proper level (A1 or A2 or B1 or B2 or C1 or C2). The words from previous levels must be also included to the texts.

4. It is recommended that the studied material be easy to understand. The new words should be in accordance with the word sheet, as per point 3. The new words from the text should also be used in the exercises. Every 3–5 lessons have a summary lesson, including all new words and grammar from the previous lessons. It is recommended to repeatedly listen to the lessons and to practice listening to the text and reading at the same time.

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PHILOSOPHICAL SCIENCES

SOCIAL USEFUL PURPOSES OF NON-PROFIT ORGANIZATIONS

Matkarimova J.D.
Doctor of Science (DSc), Associate Professor of the Department of "Social Sciences" of Tashkent State Transport University
DOI: 10.5281/zenodo.7994867

Abstract

This article analyzes the useful goals of non-profit organizations for the benefit of society based on foreign experiences. The goals of strengthening the legal status of non-profit organizations, their independent activities and organization of donations are also studied. In common law countries, there are less "hybrid" forms of non-profit organizations, since charities in these countries can always carry out almost all business activities. At the same time, the socially useful goals of the organization (regardless of the form) are considered as non-profit organizations, since their main function is officially declared as "service to society".

Keywords: non-profit organization, hybrid, socially useful, service to society, public interest, independent activity, civil associations

INTRODUCTION

A distinctive feature of the regulation of the activities of non-profit organizations in the legislation of countries where common law applies is the initial possibility of using a corporation, a limited liability company to obtain the status of a non-profit organization. Sometimes this form is filled with a certain legal feature. At common law, the purposes of private organizations are not primarily a matter of legislative regulation; the presumption that it was established to carry out legitimate purposes applies. At the same time, restrictions were placed on trade organizations and legal practices requiring special permits. In relation to non-profit organizations in common law countries, there are fewer 'hybrid' forms than on the continent (indeed their activities may be 'hybrid'), as charities in these countries (from the UK onwards) are each could always carry out almost all business activities. At the same time, since the main function of companies is officially declared as "service to society", the socially useful goals of the organization (regardless of the form) are considered as non-profit organizations, since they are not "self-financing". Mandatory (although not always effective) follow-up control in connection with the company's compliance with the objectives, first of all, many of them have tax benefits. Thus, the activities of any organization are divided into taxable and non-taxable types.

In common law countries, the term "Non-Governmental Organizations" is rarely used in the academic literature, as state-sponsored organizations and government agencies traditionally fit the definition of NGOs. In this regard, all NGOs are usually called "non-profit" (non-profit - not for profit), and can also have the status of "public benefit" and "charity" organizations.

Currently, in common law countries, the organizational forms of non-profit (especially charitable) activities are regulated by law, although there is a lot of judicial precedent in this area. Therefore, the "independent" and "non-profit" status of the organization must be confirmed in the courts.

The activities of non-governmental non-profit organizations in Bulgaria are regulated by the Law "On Non-profit Legal Entities" adopted in 2001. This law regulates the composition of government structures and the procedure for the activities of non-governmental organizations (voting procedure, quorum, etc.). However, in addition to court registration, there are organizations that can be registered as public organizations by the Ministry of Justice (with privileges).

The legal status of associations in Turkey is based on Article 5253 of November 4, 2004 [1] and Article 72 of the 2001 Civil Code [2], associations are established by three main governing bodies: the general board, the executive body, and the audit commission (supervisory board). The Law on Unions also defines the powers of these bodies. The association acquires the status of a legal entity after submitting the charter and other documents to the city government. According to the law, in accordance with Article 62 of the Civil Code, the Association must convene its first meeting and organize internal management bodies within 60 days from the moment the charter is sent to the registration body. Article 74 of the Civil Code and Law and Article 9 of the Law "On Associations" govern internal management. Meetings should be held at least once every three years. The head of the association is authorized to check the activity of the association in order to achieve the goals established by law. He also checks the procedure of keeping accounts, presents the control results to the executive body and the general meeting for consideration. According to Article 23 of the law, newly elected members of the executive and control bodies are required to submit reports to the governor within 30 days after the general meeting.

In Poland, non-governmental organizations are usually created in the form of associations and foundations. According to the Law on Associations of 1989, an association must be registered in the place of incorporation (Article 8). After that, information about the Association is entered into the State Court Register. Each association must establish at least three leading bodies: the general council, the governing body and the internal control body. The order of their creation, composition and powers are regulated by the statute. Com-

pliance with the law will be checked at the time of registration with the local court. In May 2016, the Law "On Association" was amended (Articles 40-42), according to which a new type of association was introduced - "simplified"[3]. Such an association does not have the status of a legal entity (paragraph 1 of Article 40), cannot establish local branches, cannot join the union of associations, have legal entities as founders or participants, carry out economic activities, make any contribution or charity. may accept donations and have participant contributions (Article 42). Article 22 of the Law allows the formation of associations of associations, which form at least three associations. Other legal entities may also be part of the founders.

Article 3 of the 1984 Law on Foundations [3] provides that a foundation can be established on the basis of a notarial document expressing the will of the founder. The law does not specify a minimum or maximum payment. If the company plans to carry out business activities, the Fund must have at least 1000 Polish zlotys*. The fund may engage in business activities to achieve its goals (Article 5, Clause 5). It is noted that the existence of authorized capital in each fund is considered the only mandatory body of the organization - management body. There are no other special requirements in the legislation.

In Sweden, "non-governmental organizations" are non-profit or non-profit community-based organizations. A general approach to them is that no registration is required. If an NGO does not carry out any commercial operations, it must be registered with the Swedish Patent and Registration Office under the 1974 Trademarks Registration Act. In order to register a non-governmental organization as a legal entity, the minimum requirements must be met: the NGO must have a founding document and an executive committee. Finland, unlike Sweden, has Association Act 503/1989 [4]. In its articles 7 and 8, the basic rules and internal rules developed during the formation of the association, the minimum and maximum number of members of the executive committee and auditors, their term of office, the reporting year, the conditions for choosing the annual committee and auditors, as well as the general the date of the meeting is indicated. Association registration is carried out by the National Patent and Registration Office. The application for registration of the association shall be submitted in writing together with the charter and internal rules. The state registration body verifies the correctness of the information and its name and other characteristics. Associations may be given time if there are problems with registration. All changes made to the constituent documents, as well as the authorization to sign on behalf of the association, must be registered. The law regulates the voting procedure at the general meeting of the association, including possible special forms (by mail, etc.). If the meeting is not held in a regular manner, each of the members of the association has the right to demand its convening. Emergency meetings can be held.

The main law on non-governmental non-profit organizations in Latvia is the Law on Associations and Foundations of 2003.[5] (The 1992 Act applies in part). Article 12 of the Law applies to associations and private foundations. The law does not apply to political parties, religious organizations, trade and trade unions, and public foundations, as each type of such organization is regulated by special laws. The law adopted in 2003 contains a set of rules regulating the internal structure of non-governmental non-commercial organizations. At least two people are required to establish an organization. When the association is established, the legislation requires only two governing bodies: 1) general meeting of participants; 2) an executive body consisting of one or more members. Unlike the 1992 Act, there is no requirement to appoint a permanent auditor or an audit committee - their duties can be carried out by the executive. In addition, a non-governmental non-commercial organization has the right to establish other management bodies or determine the internal structure at its discretion according to the main contract. Charter non-profit organizations, as well as the changes introduced, must be transferred to the register of non-governmental non-profit organizations, and the organization must be registered in the national registry in order to acquire legal capacity. If the registration body does not comply with the requirements of the law, the registration period will be extended and a time will be set for making changes to the charter. If changes are not made, the registration body will make a decision to refuse registration. The decision of the registering body can be appealed to the administrative court in the general administrative procedure.

In federal countries (USA, Canada, Australia), the status of joint ventures is usually regulated at the level of federal entities, but "preferential treatment" is given at the federal level. There is no specific law governing NGOs in England and Wales. According to Article 1 of the Charity Law adopted in 2006, they are organizations established "solely for charitable purposes". Article 2 states that charity "serves the public interest" which includes, inter alia, preventing and combating the spread of poverty, promoting education, spreading religion, protecting human rights, and protecting and improving the environment. In this way, "charitable purpose" can be interpreted very broadly. 1-44 Charity Act 2006 was replaced by Charity Act 2011. Any organization, if it is a charity and is duly registered, must demonstrate that its aims are for the "public good". This requirement is imposed on every organization. A charity does not have goals, some of its activities are aimed at the welfare of society, some are not. The State Charity Commission examines the organization's activities to determine whether the goals of the organization's activities serve the public interest or not. If the Charity Commission considers that social requirements are not met, it will not be registered. The Commission may require a change of purpose before registering an organization to ensure that its purpose or activities meet the "public interest requirements."

The most common historical form is charitable assistance (not a legal entity), sponsors of a charitable organization have the following obligations to perform socially beneficial functions:

1) to ensure the implementation of charity goals for the benefit of society;

2) To comply with the instructions given by the Charity Commission for socially beneficial purposes;

3) to submit full information about their socially beneficial activities to the annual report of the trustees' councils.

A charity fund can use any property without restrictions on its content. At the same time, the sponsors of the charity are required to report to the beneficiaries (not always a fiduciary) about the progress of the charity. Adherence to the "Public Welfare Criteria" - the global obligations of charity sponsors; this is a requirement that is always implemented, not just at the time of registration.

In the US and Canada, non-profit organizations do not need to do this at the state (provincial) level, where necessary, as state (provincial) legislation regulates their status. There are no state independent civil unions in the United States. All associations were established by state or municipal authorities, which played the most important role in this regard. The oldest associations were townships known as "city corporations". The first educational institutions - Harvard (1638) and Yale (1701) were established on the basis of state grants and were managed by priests who were representatives of the church and also under the patronage of the state [6]. The logic of formation of organizational and legal forms of non-governmental non-commercial organizations can be observed by analyzing the history of the US legal system. The first form used for non-commercial purposes was traditionally the trust. The trust was established in the 18th century to manage assets consisting of contributions and donations to city corporations, early educational institutions, and religious organizations. However, American courts intervene in the activities of charitable funds that receive donations. For example, according to the court, in 1993, one of the donations made at Cornell University exceeded the limit established by the state for this educational institution. Common law has defined the requirements for a trust organization used by US courts. The founding documents of a trust must contain three main elements that describe it: the trust, the object and the intention to establish the purpose. The documents constituting the trust define the following: the purposes of the trust; the property entrusted by the founder to the trustee; the names of the beneficiaries or, if the trust is created for charitable purposes, the mechanism by which the beneficiaries can be identified; methods by which trustees manage property for the benefit of certain persons or for certain purposes [7].

CONCLUSION, In addition to bona fide requirements, the requirements of US law of a targeted nature and the inability to establish a clear corporate governance structure have led to the establishment of organizations with effective corporate structure and targeted specialization. The corporation as a general organizational and legal form helped to expand the activities of associations. Creating an internal corporate structure for non-profit organizations has benefited the business community, which defines the most effective governance model for a charitable corporation. It should be noted that the US business community has traditionally been the main source of funding for NGOs. Funds became the next organizational and legal form that ensures the efficiency of management and the closest connection with business. During the rapid development of capitalism, the establishment of funds corresponded to the interests of big capital. In particular, after the death of G. Ford (the founder of the famous Ford company) in 1947, the voting shares of the companies founded by him were transferred to relatives and the voiceless - the Ford Foundation. Thus, the Ford Foundation was exempted from paying taxes and collected a large amount of money.

Later, in American law, non-profit organizations gained the ability to make a profit, allowing the state to "kill two birds with one stone":

1) financial reporting requirements have been strengthened, as profit-making includes strict and detailed reporting of income and expenses;

2) non-governmental non-profit organizations that provide educational, medical and other socially important services to the population have been equated in the economic situation with commercial organizations that traditionally provide services to the population in the United States.

In the USA, the rapid development of independent non-profit organizations in modern forms begins: 90% of current NGOs were formed after the Second World War [8]. Currently, there are approximately 1.4 million registered charitable organizations in the United States. The most common analysis of US legislation allows determining the following characteristics of a non-profit organization: its purpose ‗ "public interest"; it acts as a "non-harmful" charity; it is based on self-management and self-sufficiency of internal management; subject to compliance with the necessary criteria and conditions, he is exempt from federal taxes, as well as from taxes on property and funds transferred to him.

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THEOLOGICAL AND ANTHROPOLOGICAL APPROACHES IN RELIGIOUS STUDIES

Media Zainul Bahri
Faculty of Theology, Syarif Hidayatullah State Islamic University (UIN) of Jakarta
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Abstract

This article discusses two important approaches in religious studies: theological and anthropological. The theological approach is a way of understanding religion by reading religious texts such as the scriptures or other sacred religious texts, while the anthropological approach is understanding the relationship between religion and human culture. In fact, theological approach cannot be separated from the anthropological because theological understanding emerges in the historical and cultural context in which world religions emerge. This article is an analytical descriptive study.

Keywords: Religious studies, Theological and Antropological Approaches, E.B. Taylor, Clifford Geertz

Introduction

Since long time ago, many people have considered religious studies or scientific studies of religion as something absurd and unpleasant. According to Ninian Smart (1927-2001), professor of religious studies over more than four decades, and a powerful advocate of the study of religion for the enrichment of common humanity, it is called absurd because scientific approaches tend to distort inner feelings and responses to the transcendent/divine. It is called disliked because scientific study brings a (cold) rational approach to what should be "warm and thrilling." This assumption is wrong, although it is completely understandable. Of course the humanities—including religious studies—must deal with inner feelings, because humans cannot be understood if their emotions and religious experiences are not understood.. This is definitely different from the approach in the natural sciences which treats 'rocks' or 'electrons' as inanimate objects [1]. Religious studies are also disliked due to the problem of the strengthening of religious fundamentalism today which is "allergic" to scientific religious studies, because it is considered 'to endanger' faith, 'mislead' or at least make a religious person away from his/her religion because it examines existing religious beliefs with certainly scientific methods that regard religion as part of culture so that it is legitimate to be 'criticized' explicitly.

What is Religious Studies?

According to Smart, first of all it must be distinguished between "doing theology" and "studying religion". To do theology, in a general understanding, is to articulate a belief. Processing and making arguments and looking for justifications—although from scientific materials—but in order to strengthen their religious beliefs. Included in doing theology is writing works with the purpose of preaching, showing the weaknesses of other people's beliefs—and at the same time-- showing the perfection of one's own religion. However for Smart, in the study of religion itself, theology is part of the phenomenon that must be understood. For example, the architectural writings of Le Corbusier, a French architect, of course, must be included as material in compiling the history of modern architecture, even though Corbusier's own writings aim to be practical and are part of his activities as an architect. Architectural historians need not be architects. In the same way, a scholar of the scientific study of religion can benefit from theological works without necessarily being a theologian.

Studying religion scientifically means explaining religious phenomena practiced by its adherents, whether observed from the aspects of their religious experience, social relations, cultural, economic and political behavior related to their religious activities, with a certain set of scientific approaches or methods. According to Smart, the scientific study of religion is aspectual, polymethodical, pluralistic, and without clear boundaries. *Firstly*, It is aspectual in the sense that religion must be treated as an aspect of existence. People behave or react religiously, this is what is raised by religious studies; as economics elevates human economic behavior. *Secondly*, The study of religion is polymethodical in the sense that different methods or disciplines are used to discuss these aspects. Therefore, a scholar of religion needs to understand religion with historical, philosophical, theological, sociological, psychological, phenomenological and other approaches. *Third*, It is pluralistic in nature because there are many religions and religious traditions, and it would appear that religious studies that are carried out seriously will be definitely attracted to more than one religious tradition. *Fourth*, The study of religion is without clear boundaries, because it is impossible or unrealistic to generalize a standard definition of religion. One definition (of religion) may describe some special elements of one or two religions, but may not include many other religions [2].

Religion as part of culture is a religion that being understood, lived and practiced by historical humans and because of that it becomes part of the object of scientific study. Included in this are products produced by religious actors such as religious texts or religious institutions and others. All products of religious thought and activity are usually closely related to political, economic, cultural and social activities which further strengthen religion as an object of scientific study.

The theological approach is a way of understanding religion by reading religious texts such as the scriptures, sayings of the prophets and writings of religious scholars and saints in religious traditions. The theological approach is a very common way of understanding religion in world religions. However, it turns out that religious sacred texts were born and developed according to the culture in which these religions arose. The

holy book (scripture), for example, was born in a certain historical and cultural context. Likewise, the sayings of the prophets which later became religious laws also appeared in a particular culture. Therefore, to understand Islam one must understand Arabic culture. Likewise for Hinduism one must understand Indian culture, for Confucianism and Taoism one must understand Chinese culture, for Judaism one must understand culture in the Middle East, and so on. Professor Hassan Hanafi, a leading Egyptian Muslim intellectual, states that God's revelation came down in a dynamic historical-anthropological context, not static [3]. The Shari'a of the prophets will vary according to their respective cultural contexts which are indeed unique and particular. In the language of Professor Shahab Ahmed (2016), religion and religious teachings cannot be separated from Pre-Text, Text, and Con-Text [4]. Therefore, theological and anthropological approaches are two ideal approaches to understand religion and become interesting approaches in religious studies.

Theological Approach

This approach in a fairly long historical period is the most dominant and most influential approach in religious studies or the comparative study of religions, even to this day, although it no longer dominates. For centuries, theology was considered as the "Queen of the Sciences", especially in the Jewish, Christian and Islamic world. This is a normative and subjective approach. With this approach, a follower of a religion, whether Christianity, Islam or another religion, when making a theological study, usually does one of two things: *first*, internal study. In this case, a religious scholar/researcher is an insider who tries actively in his scientific activities to preserve and promote the superiority of his religion and defend it from threats or attacks from other people. *Second*, *external.* In this case, a researcher or adherent of a certain religion conducts a study of other people's religions/beliefs to 'assess' and 'judge' them by the measure of the researcher's religion (or prescriptive attitude). In the past, this approach was also called the textual approach or the biblical approach with its main characteristics: apologist and polemist.

In Christian history, for example, great theologians like St. Augustine of Hippo with his works of *On Christian Doctrine and Confessions*, Thomas Aquinas with *Summa Theologica*, Paul Tillich with *Systematic Theology*, Karl Barth with his *magnum oppus Church Dogmatics*, and many others, use a single theological approach. They do not only make theological works that campaign and deepen the superiority of Christian teachings, but also evaluate other religions. Thomas Aquinas for example taught that all religions outside of Christianity are false. We can read volumes of Christian theologians from the Middle Ages to the modern with an apologetic theological model.

Islamic studies in the middle age did the same way. We can read pre and medieval theological works such as al-Ghazali with one of his works, *al-Qawl al-Jamīl Fi Radd 'alā Man Ghayyara al-Injīl*, Ibn 'Arabi with *al-Futūhāt al-Makkiyyah*, Ali Ibn Hazm through *al-Faṣl Fi al-Milal wa al-Ahwā wa al-Niḥal*, Abdul Karim Shahrastani through *al-Milal wa al-Niḥal*, Ibn Taymiyyah through *al-Jawāb al-Sahīh Liman Baddala Dīn al-Masīḥ*, and Abdul Qahir Ibn Tahir Ibn Muhammad al-Baghdadi through *al-Farqu Bayn al-Firaq.* These works also not only declare the perfection of Islam but also strip away the flaws of other religions. In modern times such works have appeared more and more.

Theology vis-a-vis Religious Studies

As already mentioned, the task of a theologian is to promote the superiority of his religious tradition and convince people that the doctrines and teachings of this religion can give meaning and hope in an uncertain life. But more than that, a theologian can also discuss important contextual issues such as the environment, global climate change, human rights, problems of intolerance, marginalized groups of people and others. All of these issues are given a theological value. To what extent theological doctrines can respond to these important issues. However, a theologian is still an 'insider' who interpreting his theological views.

The discipline of religious studies or comparative study of religions is different from the theological tasks above, at least that's what happened in universities in the West that have departments of religious studies. Scholars of religious studies must be designed not to be 'insiders' in any religious tradition. His task is to carry out scientific studies of religious traditions with certain scientific approaches, whether with phenomenological, historical, sociological, anthropological, hermeneutic or other approaches. Thus, a scholar is not an 'insider' playing the role of a theologian addressing a particular religious audience. Even though a scholar of religious studies is a religious person or has adherence to a particular religion, he must avoid the 'normative role' of a theologian. He must avoid judging, determining, and promoting the values, norms and claims of the religious traditions he studies [5]. His task is to classify and analyze the claims and contexts around that tradition, whether it is history, culture, or social interactions that give rise to the theological views and claims.

Indeed, here it must be understood the fundamental difference between religion, the study of religion, and being religious [6]. Many scholars, students, and especially non-graduate people are confused to distinguish these three points. In Indonesia, almost all religious scholars who carry out scientific studies on religion—even become professors in (certain) religious studies, but at the same time often become theologians in the midst of their society or community. When speaking in public as well, he 'unifies' the attitude between being a scholar who tries to explain his scientific analysis while also making values, defining, and promoting his religious tradition. This attitude is similar to that of Christian theologians in the West, also in Asia in the 1950s to 1990s. However, in the West, there is gradually a clear distinction between theological figures and scholars of religious studies by looking at their actions and works..

To be a scholar of religion who is proficient in religion does not have to be a theologian (insider), just as someone who is religious does not mean that he cannot become an expert in scientific studies of religion. This is in accordance with the adage that "to be good at teaching biology you don't have to be a frog or a fish

first". Currently, when the study of religion or Comparative Religion is approached with a multi-disciplinary scientific method, the lecturer of religious studies does not have to be someone who is trained in that discipline. Sociologists, anthropologists, political scientists, psychologists, philosophers, and cultural scientists can teach religious studies or Comparative Religion with their scientific approach or perspectives. Indeed, religion is the main object for religious studies, but its studies are no longer dominated by only scholars in religious studies or theologian [7].

Anthropological Approach

This approach seeks to understand human-made cultures related to religion. The extent to which religion influences culture and vice versa, the extent to which the culture of a group of people influences religious interpretations. In the history of religious studies there are several figures who have always been the reference for this approach, which became widely known as the study of Religious Anthropology. For example Edward Burnett Taylor (1832-1917), James George Frazer (1854-1941), Andrew Lang (1844-1912), Wilhelm Schmidt (1868-1954), Clifford Geertz (1926-2006) and others. We will focus on just two figures, Taylor and Clifford Geerzt, whose thoughts were discussed in the department of religious studies.

Edward Burnett Tylor (1832-1917)

Edward Tylor is a scientist (an anthropologist) who most of his life is used to direct attention to primitive people, especially to the Indian tribes in Central America. For his very serious observations, he produced quality works such as *Anahuac: Or Mexico and The Mexican Ancient and Modern (1861)* and *the Early History of Mankind and the Development of Civilization (1865)*. However, his peak work, *Primitive Culture* (1871), which he wrote in two large volumes, has led him to become a renowned British anthropologist. *Primitive Culture* can be called a 'bible' for later scientists who were deeply inspired by what they called "*Mr. Taylor's Science*" [8].

At first, Tylor was not interested in religious matters. However, his involvement in the life of primitive people requires him to understand their beliefs about spirits, gods, myths, and the origins of those beliefs. After a long struggle with primitive culture, Tylor came to the conclusion that religion is "belief in something spiritual". According to him, all religions, big and small, primitive and modern, have always based their belief in spirits who think, behave and feel like humans. Therefore, the essence of every religion is *animism* (*anima:* spirit), namely belief in a living being, who has power, who is behind everything. This animism that becomes the focus of Tylor's attention.

In primitive society, initially two questions and concerns arose: *first,* what is the difference between a living and a dead body; what causes humans to wake up, sleep, faint, get sick and die? *Second,* what form appears in human dreams and fantasies? Observing these two problems, "*the ancient savage philosophers*" of primitive society then tried to answer them in two stages: *first,* by stating that every human being has two things, namely the soul and spirit (*phantom*) as a shadow of the second self for soul. These two things are also considered as an inseparable part of the body. *Second,* by combining the soul and spirit earlier, the 'wild philosophers' succeeded in discovering the conception of a Soul that Has a Personality [9]. Their vivid experiences of death and dreams allowed primitive peoples to think for the first time of the simple theory that all life is caused by a spirit or spiritual principle. They regard the spirit as a very ethereal, insubstantial shadow of a human being with a very subtle, thin and shadow form. He is the one who gives life to humans [10].

Furthermore, according to Tylor, animism has developed. Initially, people only thought of an individual spirit as something small and specific, merged with the trees, rivers or animals they encountered. Then, this spirit power started to grow. In the minds of primitive peoples, the spirit of a single tree gradually developed into the spirit of the forest or the spirit of the whole tree. Furthermore, the same spirit will also be considered increasingly separated from the object that first mastered by further strengthening its own identity and character. Each place and region has spirits of different strengths and levels: the highest spirit, the high spirit, the low spirit, and the lowest spirit. There are spirits of wind, rain and sun which are higher in rank than the spirits of trees and rivers. The tree spirits can't do anything about it if the sun spirit decides not to rain so the trees dry up or the Rain Goddess decides to destroy the trees by sending a flood [11]. With a theological view of the various levels of spirits and their powers, the worship of many spirits (*polytheism*) arose.

Such a complex polytheistic system was characteristic of the religious model of the most ancient times. No matter how simple, this civilization will always seek the highest level, namely when they try to form a society that has one God, a single power that overcomes other gods. According to Tylor, slowly but surely, every civilization will lead to a new direction, the final stage of animism, namely belief in one God (*monotheism*), although the paths taken are not always the same. And without any doubt, the Christian and Jewish societies (including Islam, sic.) are the best examples of this last stage. They have formed a very logical final formula of the entire developmental process that had begun centuries before, shrouded in the dark fog of prehistoric times. That is, when the first human whom Tylor called a 'wild philosopher' concluded that spirits controlled the world around him [12].

With the various explanations above, Tylor wants to show that the origins of religious belief (God) in mankind actually evolved: from animism to polytheism and ended in monotheism. Tylor, who was born and raised in England, was certainly influenced by Charles Darwin's theory of evolution. Darwin, who published *The Origin of Species* (1859), later became a byword and a highly controversial figure, especially in England. According to Daniel L. Pals, his *idea of development* took its most obvious form in Tylor's thought. In the following years, as the debate intensified, many thinkers emerged who raised troubling questions about basic elements of Christian beliefs such as the historical truths of the Bible, the truth of miracles and the question of the divinity of Jesus Christ. With the publication of *Primitive Culture* which brought a new theory about

the origins of all religions, including Christianity, the doubts that had previously settled in European society grew stronger [13]. Tylor's research results actually show conclusions similar to those of sociologists like Durkheim, for example, that religion is actually the result of social (and cultural) construction of humans, and not revelations handed down by God as believed by believers.

Tylor's theory was then met with resistance, especially from the church scholars. Andrew Lang for example, a folklorist from Scotland, who had previously been a follower of Tylor's theory, later refuted it. Based on the research he did, there is evidence that primitive society from the beginning has had embraced monotheism. Primitive religious understanding, says Lang, never began with polytheism and their original monotheism was not a complete development of animism. Lang's observations later received support from Wilhelm Schmidt, an anthropologist and Catholic priest from Germany. He also argued that the religious understanding of all primitive societies was monotheistic from the start, and monotheism was the original form of all human religions that have existed, until the present day [14].

In religious studies, the question arises: in studying religion, why does it always have to start with "where did religion originate?" To this question there are two possible answers. *First*, it is a "general symptom" in the Humanities discipline. If we study philosophy as a discipline, for example, we usually study the history of philosophy *first*: where and when did philosophy begin, who were the first philosophical figures, what model of philosophy first emerged, and so on. *Second,* in the Study of Religion, especially in the context of the figure of Max Müller, a British scholar with German nationality who is a philologist of Indian religions, tracing the origins of religion means an attempt to find the most original and earliest form of religion because it is considered the purest form. It is a challenging endeavor to find the purest form of religion because it will reveal a great mystery and become a basis for analyzing the historical development of religions.

Third, in religious studies, the issue of where religion originates is the most crucial problem, especially in the Western Christian world. Before the emergence of descriptive or scientific studies of religion, religious knowledge in the West was completely dominated by Theology (Theology as the "*Queen of Sciences*" also has actually become a common phenomenon in the Islamic world (East) for quite a long period of time). Therefore, in the context of Western Christianity (Europe), when anthropological, sociological, and psychological theories emerge that reject God, the question of the origin of religion is 'a life-and-death' problem that cannot be negotiated anymore, because it concerns the main things and the main thing in religion, namely the belief in the existence of God. The church, with various propaganda and proselytizing, wants to stem the understanding and movement of atheism and draw European society back into the arms of the church.

If scholars agree that the theory of the origins of religion is still important for students and academics to debate as initial knowledge, then this must be done in a scientific matter and not with the aim of preaching, namely wanting to show the superiority of religious arguments *vis-a-vis* anthropological, sociological and psychological studies that have been produced through a long series of research. What often happens is that students and academics do not properly understand the theories of the origins of religion through the first writings of the initiating scholars. What often happens, they discuss the theories through third or fourth references or through translation books, which are very likely to have reduced the main material of the theories.

In an interesting article entitled *The study of religion and the rise of atheism: conflict or confirmation?* (2011) Michael Buckley, professor of Theology at the Department of Religious Studies at the University of Santa Clara, California, explained that there was indeed a fierce battle between *Uratheismus* supporters and *Urmonotheismus* ones. The scientific quest of 19th century anthropologists, sociologists and psychologists for the culture of primitive peoples required them to seek deeper into the origins of primitive religious beliefs in the Ultimate Reality. And the results of that research then became something very bitter for the church. E.B. Taylor, for example, concluded that his scientific research had strengthened his personal position to be an agnostic who was skeptical of religious faith [15]. Sir John Lubbock through *The Origin of Civilization and the First Condition of Man* (1870) as quoted by Buckley, put forward the thesis that atheism is indeed the earliest and most primitive phenomenon of human religious. This phenomenon, before the time of Lubbock, has given fresh blood to the theory of August Comte (1798-1857) about the three stages of the intellectual development of society. Through in-depth research on religious culture in primitive societies, Lubbock finds that "*Uratheismus not in an explicit denial of the reality of any god, but in the absence within these earliest cultures of all religion*" [16].

In line with Lubbock, other scholars such as Durkheim, George Frazer, and Sigmund Freud both asserted that totem worship, as the highest representation of reality, in primitive societies was the most primordial form of belief, and the most original foundation of all religions. In looking at the religious experience in humans, Freud dived into the deepest psychic experiences of humans through what he called "longing for Oedipus" and his feelings of guilt for killing his father. Through psychoanalysis, Freud argued that basically what is called God does not actually exist, he is only an image (picture) of a great father. Therefore, if the totem is the earliest form of surrogate father, then the concept of a god or gods appears later [17].

In the same spirit as Freud, Carl Gustav Jung (died 1961), a psychologist who is also against religion, argues that what is called God is actually a representation of a number of libido energies. Through a series of psychological research, Jung believed that God is a construct of the libido that is based on the image of a mother rather than a father figure (In terms of this figure, Jung is different from Freud who refers more to the father figure) [18]. The figures above have come to the conclusion that religion can be found in the earliest

primitive humans, but not with the concept of god. Tylor, for example, although he defined religion as "belief in spiritual beings", in the view of ancient society, these so-called spiritual beings were none other than individual spirits residing in nature, not God from "another realm".

Contrary to the views of the above scholars, the supporters of *Urmonotheism* also point to scientific arguments for belief in God in the most ancient primitive societies. Wilhelm Schmidt, for example, by adopting Andrew Lang's theory of high gods, asserts through his work *Der Ursprung der Gottesidee* as quoted by Buckley, that the idea of the Supreme Being can be found in almost all cultures of primitive societies. Expressed in the same form and model, but the idea of it is prominent enough to make its position quite dominant and unquestionable. Because of this, the ideas and beliefs about *Urmonotheismus* existed in its earliest stages as the religious object of all subsequent primitive cultural models. Primitive society had no difficulty recognizing the idea of a Supreme Being. Thus, monotheism is at an early stage, not a late one, in the development of the religious thought of mankind. More than that, Raffaelle Pettazzoni, according to Buckley, shows that the idea of primitive monotheism is a form of revolution against polytheism in primitive society itself. Pettazzoni conducted research on primitive Maori society. They worshiped *Io* as the god of the sky. They also believe that *Io* is the creator of other gods like *Rangi* and *Papa.* However, in the final analysis, Pettazzoni discovers that *Io* is *Rangi* himself and it is *Rangi* who stands behind *Io* as the real God of Heaven who ultimately exalts his position as *Io* (under the name *Io*), an uncreated substance and as the initial source of everything [19]. Thus, Pettazzoni's research concluded that from the beginning the beliefs of primitive peoples were not merely monotheism, but also that they opposed polytheism by demonstrating the only Supreme Power as the initial source and creator of all things, including creating minor gods.

In the heated debate between proponents of *Uratheismus* and *Urmonotheismus,* on the academic front, the research that has been carried out by Lubbock, Taylor, Evans-Pritchard, Frazer, and Durkheim for example, or evolutionists such as Darwin and Robert N. Bellah, who most recently, has very strong influence, and become a mandatory reference for the reviewers. More than that, it has also become a popular general reading. On a broad scale, their works together with Darwin's theory of evolution led to the strengthening of skeptical, even atheistic views and attitudes in European society in the 19th century. Of course, such anthropological, sociological, and psychological research that underlying on observation is difficult to disprove, although there is always the possibility of being broken with different evidence and new discoveries. During the golden age of the scholars, even to this day, the church (theologians) or scientists who agree with the church always show confrontation.

This attitude of confrontation, even hostility, was regretted by Buckley. In the context of the dominance of theories of the origins of religion which ignore the revelation of God, Buckley proposes the scientific discipline of Religious Studies to explore theological endeavors that differ in its nuance from what was carried out by Theological Studies in the 19th and 20th centuries. In other words, it is no longer time for theologians and theological disciplines to continue to be hostile to scientists. If the study of theology focuses on the sciences of divinity, then the theologians must undertake a journey towards in-depth knowledge of anything about God that will produce a positive and enlightening perspective. Buckley wrote:

There is no time now to argue and nuance this suggestion with the distinctions it obviously cries for, but only to propose that the scientific study of religion could well call the theological enterprise to an inquiry quite different from that which obtained in the nineteenth and twentieth centuries. For, to allow the final word to Nicholas Lash: "Every Christian, and hence every Christian theologian, is called to journey in the direction of deeper knowledge of the things of God, and the journey is a homecoming, for God is our end as well as our beginning." [20]

If human culture has been explored in such a way by scientists in various scientific disciplines, then interest matters to researchers of scientific studies of religion, according to Buckley, is to reveal things related to God. For example, revealing important moments of human spiritual experience about God. Buckley rhetorically asks: can Christ be seen as giving light, so that it is interesting to study, rather than having to compete with controversial problems that have been found in scientific studies of religion? Christian theologians may be able to study well about the illumination of Jesus without having to look for data on human culture, but they can sufficiently show what can be learned from God. *Nostra aetate* produced by the Second Vatican Council is a reflection of the spiritual wealth of the Holy Father. The Nostra, according to Buckley, has acknowledged that God's Light can illuminate anyone of His creatures and in any religious tradition. Can Christian theologians make a scientific study of the inner wealth of Christian figures about God to produce such amazing Nostra? [21]

Clifford Geertz (1926-2006)

Another anthropologist who deserves to be our example is Clifford Geertz. Geertz, one of the most well-known American anthropology masters and made famous in a small town in East Jawa-Indonesia, because of his research which was highly reckoned with in the 1970s due to the new concept he initiated, namely interpretive anthropology. Geertz's career began when he was a doctoral student in his second year at Harvard, Geertz and his wife left for the island of Java and settled for two years in Mojokuto (Kediri) East Java, to study a heterogeneous society in terms of culture and religious beliefs. After receiving his doctorate in anthropology in 1956, he accompanied his wife again and came to Indonesia, specifically to the island of Bali for an anthropological research. Geertz's main mission as an anthropologist in Java and Bali is ethnography, which is to provide a detailed and systematic description of the people on the two islands in order to reveal

how the various aspects of people's lives can merge into an intact culture [22].

In 1960 Geertz published *The Religion of Java*, a very famous and controversial work on the *abangan-santri-priyayi* trichotomy in the pattern of socio-religious relations in Javanese society. It is this work that is always remembered by the anthropological community around the world and brought Geertz to the stage of fame and a special place in the world of American anthropology. After that, other quality works were also appeared, *Agricultural Revolution* (1963), *The Socio-History of an Indonesian Town* (1965), *Islam Observed* (1968), *The Interpretation of Culture* (1973), *Meaning and Order in Morocean* (1980) and *Local Knowledge* (1983).

In an essay entitled *Thick Description: Toward an Interpretative Theory of Culture*, which is found in *The Interpretation of Culture*, Geertz reminded, as quoted by L. Pals, that although the culture word is understood by anthropologists with different meanings, but the key to understand is the idea of meaning (meaning or significance). Humans, said Geertz by quoting Weber, are "animals confined in webs of meaning (*significance*) that they spun themselves". Therefore, if someone wants to do what anthropologists have done, namely to explain other people's cultures, then he has no other choice but to use the method that the British philosopher, Gilbert Ryle, called "Thick Description" (in-depth painting). One must be able to describe not only what actually happened, but also (explain) how one's understanding of that incident [23].

Ryle gave the example of two kids winking. The first child blinks his eyes without realizing it (accidentally) because of the motion of his eye nerves, while the other child blinks his eyes at someone else on purpose. Physically or "*thin description*" (a shallow painting) shows that the two events are the same. However, if one explores further the significance of each event, one will find a difference. The first incident is meaningless. On the other hand, the second blink is full of meaning that the second child wants to convey. "*Thick description*" which involves the meaning of the event shows that the wink of the second child (wink) is much different from the blink of the first child (twitch). Therefore, according to Geertz, it can be understood that ethnography—as well as anthropology—in general always involves "deep painting". His task is not merely to describe the structure of primitive tribes or parts of rituals that are more specific to religious people, for example the Muslim fasting practice in the month of Ramadan. Its main task is to search for meaning, find the essence behind one's actions, the meaning that lies behind all life and ritual thoughts, structures and beliefs of the studied objects [24].

However, it must also be remembered that a culture is not just a matter of meaning, or only as something that is purely filled with symbol systems like mathematics. Customs or people's behavior must also be observed because culture finds its articulation through behavior, or more precisely through social action [25]. If interpretive anthropology is a way to see the system of meaning and values that people use in carrying out their lives, then this interpretive anthropology will always be interested in religious issues. Geertz was very sure of that and he showed it in his very famous book, *The Religion of Jawa* (1960). Anthropologists call this work as the best ethnographic book in the American anthropological tradition. Geertz not only conducts in-depth studies by being directly involved with the life and language of the Javanese people, but he also discusses in detail the complex relationships between Islamic, Hindu and local indigenous beliefs (*Abangan, Kejawen*: Javanese religion). In this book, Geertz sees religion not merely as an expression of social and economic needs but also as a cultural fact as it is in the culture of the Javanese people [26].

In his research on the unique culture and religion of the Balinese people, Geertz made a conclusion that any study of religion will be successful if it takes two important steps: *first,* one must start by analyzing the set of meanings contained in the religious symbols themselves. According to Geertz, this is quite a difficult task. *Second,* what is no less difficult, namely because these symbols are closely related to the structure of society and the psychological aspects of members of the community, the series of symbols must be continuously traced, whether from the way of creating, the process of receiving and interpreting them and deviations of those meanings. This relationship can be analogous to an image with three points forming a triangle. The first point is for symbols, the second point is for society, and the third point is for individual psychology [27].

Another example of the use of interpretive anthropology is Geertz's work entitled *Islam Observed* (1968). This book describes a comparison of Indonesian and Moroccan Islamic culture. Besides these two countries have population majority of Muslim, both have also experienced drastic social changes in the modern era. Most Indonesians work in agriculture (please note that Geertz's research was conducted in the 1960s) and the majority of Moroccans work as herders. Both of them had been colonized by Western nations (Indonesia by the Dutch and Morocco by the French). Geertz wanted to see the important role religion has played and is currently playing in the process of social transformation that has taken place in both countries [28].

In the process of the entry of Islam into Indonesia, in this case Java, Geertz created a description of the legend of Sunan Kalijaga as a *Wali* (saint) who was very popular in spreading Islam in Java. He was born into the ruling family of the time, during the Hindu-Buddhist era, when the high-caste ruling class was considered the country's spiritual elite. In an atmosphere of palace aristocratic life, the implementation of religious rites actually functioned as political power and religious authority for the king at the same time. The interesting thing about the legend of Kalijaga is that when he became the guardian of the propagator of Islam, who was ordained by Sunan Ampel, he did not leave his childhood Hindu-Buddhist culture. According to Geertz, he then helped establish the Mataram kingdom and took advantage of his position in royal ceremonies to introduce Islam, and one of the ways was to continue to voice the values of Hinduism and Buddhism [29].

Synonymous with the story of Sunan Kalijaga, according to Geertz, the emergence of Islam in Morocco can be seen well from the life story of a saint named Sidi Lahsen Lyusi (real name is Abu Ali al-Hasan Ibn Mas'ud al-Yusi), one of the last generation of Marabouth who lived around the 1600's. Marabouthism is a mystical understanding and practice of Moroccan Islam inherited from the Murabithun dynasty. Like Kalijaga, Lyusi is considered by Moroccan Muslims as a Wali (saint) who is knowledgeable, has noble character and has spiritual charisma so that he also has many supernatural powers [30]. According to Geertz, Kalijaga and Lyusi have a lot in common. Both emerged and played a role in critical times in the development of their society, but then they found a way out and a solution. They are both wandered from place to place eagerly searching. They are both lived in proximity: Kalijaga in the sixteenth century and Lyusi in the seventeenth century. Both of them also come from the elite of their society, Kalijaga is an aristocrat, and Lyusi is a sharif (descendant of the Prophet Muhammad) [31].

However, continued Geertz, there are significant differences between both of them in their socio-cultural context and problem solving. In Java, the crisis facing Kalijaga was the result of the weakening of the Hindu-Buddhist Majapahit and its demoralization, followed by the introduction of vital and dynamic Islam. Meanwhile in Morocco, the crisis that Lyusi finds is a society has devoted Islamic for centuries but has experienced disintegration from within, which makes society split into small groups. They need the guardian as the central figure. Therefore, if Kalijaga is looking for a solution to the crisis of his society by finding harmony and aesthetic integrity, then Lyusi is trying to overcome it by directing society to strict moral requirements (by implementating *Shariah* and morals) which are believed to be true religious teachings [32]. In Geertz's definition, the religions in Morocco and Indonesia, although both are Islamic, show very different cultures, feelings and motivations. In Indonesia (meaning Java, sic.), there is calm, patience, introspection, full of consideration, sensitivity, asceticism and even it might say almost no obsession. In Morocco, Islam is active, aggressive, passionate, courageous, tenacious, moralist, populist and obsessive [33].

Conclusion

Religion as a scientific object requires it to comply to scientific methods. Theological and anthropological approaches are two scientific methods in understanding religion critically. These two approaches cannot be separated because many normative theological aspects are closely related to anthropological facts. Anthropological studies of religion such as those carried out by Clifford Geertz show that the face of religion is very plural because it is practiced in various human cultures. In Indonesia in 1970s, for example, there is a religious model that is calm, patience, introspection, full of consideration, sensitivity, asceticism and even it might say almost no obsession. In Morocco in 1970s, Islam is active, aggressive, passionate, courageous, tenacious, moralist, populist and obsessive. However, even though in religious studies, religion is treated as empirical data (to be cold and rational), for adherents of religion (believers) it remains as something "warm and thrilling".

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PHYSICAL SCIENCES

ON THE FORMATION OF COATINGS ON A SUBSTRATE

Berdibekov A.T.,
PhD, associate professor.
National Defense University named after the First President of the Republic of Kazakhstan - Elbasy, Astana, Republic of Kazakhstan
Yurov V.M.,
Candidate of phys.-mat. sciences, associate professor
KarTU, Karaganda, Kazakhstan
Dolya A.V.,
PhD candidate,
National Defense University named after the First President of the Republic of Kazakhstan - Elbasy, Astana, Republic of Kazakhstan
Gruzin V.V.
Doctor of Technical Sciences, Professor,
National Defense University named after the First President of the Republic of Kazakhstan - Elbasy, Astana, Republic of Kazakhstan
DOI: 10.5281/zenodo.7994886

К ВОПРОСУ ОБ ОБРАЗОВАНИИ ПОКРЫТИЙ НА ПОДЛОЖКЕ

Бердибеков А.Т.
PhD, ассоциированный профессор.
Национальный университет обороны имени Первого Президента Республики Казахстан – Елбасы, Астана, Республика Казахстан
Юров В.М.
кандидат физ.-мат. наук, доцент,
КарТУ, Караганда, Республика Казахстан
Доля А.В.
докторант PhD.
Национальный университет обороны имени Первого Президента Республики Казахстан – Елбасы, Астана, Республика Казахстан
Грузин В.В.
доктор технических наук, профессор,
Национальный университет обороны имени Первого Президента Республики Казахстан – Елбасы, Астана, Республика Казахстан

Abstract

The article presents an analysis of several approaches to the theory of formation of coatings on a substrate. It is shown that, despite various modifications and refinements of the classical theory of nucleation, it is imperfect: the theory is built on the rough assumption that microscopic aggregations of atoms have macroscopic characteristics and, in general, equilibrium thermodynamic parameters; in practice, in all works devoted to the initial stage of the nucleation of a new phase, the formation of a metastable phase is considered to be instantaneous. It is shown that the probabilistic nature of the description of the nucleation process as a random Markov stationary process or one-dimensional Fokker-Planck equations requires a more rigorous justification, since a number of assumptions (no aftereffect, ordinary nature, etc.) do not follow from the physical picture of the phenomenon; since it is not the distribution functions themselves that are experimentally observable (as in quantum theory), but their moments and correlators, it is advisable to analyze the statistical regularities of the initial stage of nucleation using the Stratonovich approach. It is shown that fractal models are hardly suitable for describing the initial stage of the formation of crystallization centers. A simple model is proposed that gives some physical ideas about the process of homogeneous nucleation. It is shown that the radius of the nucleus is practically independent of the type of metal atoms, the average number N of particles in the nucleus is of the same order.

Аннотация

В статье представлен анализ нескольких подходов к теории образования покрытий на подложке. Показано, что, несмотря на различные модификации и уточнения классической теории зародышеобразования, она несовершенна: теория построена на грубом допущении, что микроскопические скопления атомов обладают макроскопическими характеристиками и, в целом, равновесными термодинамическими параметрами; практически, во всех работах, посвященных начальной стадии зарождения новой фазы, образование метастабильной фазы считается мгновенным. Показано, что вероятностный характер описания процесса зародышеобразования как случайного марковского стационарного процесса или одномерных уравнений Фокера-Планка требует более строгого обоснования, поскольку ряд предположений (отсутствие последействия, ординарность и др.) не вытекает из физической картины явления; так как экспериментально наблюдаемыми являются (как и в квантовой теории) не сами функции распределения, а их моменты и корреляторы, то целесообразно проведение анализа статистических закономерностей начальной стадии зародышеобразования, используя подход Стратоновича. Показано, что фрактальные модели мало пригодны для описания начальной стадии образования центров кристаллизации. Предложена простую модель, которая дает некоторые физические представления о процессе гомогенного зародышеобразования. Показано, что радиус зародыша практически не зависит от вида атомов металла, среднее число N частиц в зародыше имеет один порядок.

Keywords: coating, nucleation, statistics, new phase, probability, thermodynamics, distribution function.

Ключевые слова: покрытие, зародышеобразование, статистика, новая фаза, вероятность, термодинамика, функция распределения.

Если подложка имеет высокую температуру, когда происходит интенсивная диффузия ататомов, то образование покрытий (пленок) на подложке происходит по одному из трех классических механизмов роста. При выполнении условии $\gamma_2 \geq \gamma_{12} + \gamma_1$ (γ_1 – поверхностная энергия подложки, γ_2 – поверхностная энергия покрытия (пленки), γ_{12} - поверхностная энергия раздела фаз – между подложкой и пленкой) или модель Ван-дер-Мерве, когда второй слой не начинает расти, пока рост первого слоя не закончится (рис. 1).



Рисунок 1. Модель Ван-дер-Мерве

При выполнении условии $\gamma_2 \leq \gamma_{12} + \gamma_1$, возникает остовковый рост или модель Фольмера-Вебера (рис. 2).

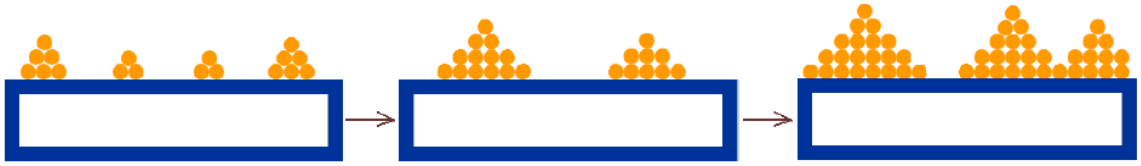


Рисунок 2. Модель Фольмера-Вебера

При выполнении первоначально условия $\gamma_2 \geq \gamma_{12} + \gamma_1$, а затем условие $\gamma_2 \leq \gamma_{12} + \gamma_1$, то реализуется модель Странстки-Крастанова, в которой покрытие растет сначала послойно, а затем образуются трехмерные островки (рис. 3).

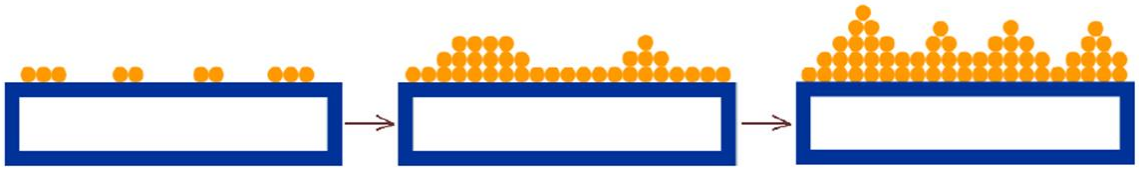


Рисунок 3. Модель Странстки-Крастанова

Классические механизмы роста покрытий основаны на теории фазовых превращений, которому посвящены работы Гиббса, Колмогорава, Джонсона, Мэла, Аврами (подробно смотри [1]). В зарубежной литературе данная теория известна как «KJMA theory». Классические механизмы роста покрытий определены в работах Фольмера, Френкеля, Зельдовича [1]. После них было предпринято множество попыток усовершенствовать классические механизмы роста покрытий, однако они не привели к ее радикальному изменению. Согласно классической теории, образование зародышей новой фазы в старой метастабильной фазе рассматривается как флуктуационный процесс. При допущении макро-

скопических свойств для малых агрегатов изменение свободной энергии образования зародышей, состоящих из i молекул, равно:

$$\Delta F = (\mu_1 - \mu_2)i + S\gamma_{12}, \qquad (1)$$

где μ_1 и μ_2 - химические потенциалы соответственно старой и новой фазы; S – поверхность зародыша; γ_{12} – поверхностная энергия на границе раздела фаз. Из условия экстремума $\partial\Delta F/\partial i$ следует:

$$\Delta\mu = 2\gamma_{12}\upsilon_2/r_{\hat{e}}, \qquad (2)$$

где υ_2 – объем одного атома (молекулы) фазы 2, а $r_к$ - критический радиус сферического зародыша.

В случае кристаллизации переохлажденного расплава $\Delta\mu$ и, соответственно, r_K можно выразить через переохлаждение:

$$r_{\hat{e}} = 2M\gamma_{12}T_0/\rho q\Delta T. \qquad (3)$$

Тогда работа образования критического зародыша сферической формы также выразится как функция ΔT:

$$W = \Delta F_{\hat{e}\eth} = \frac{16\pi}{3}\left(\frac{M}{\rho}\right)^2 \frac{\gamma_{12}^3 T_0^2}{q^2(\Delta T)^2}, \qquad (4)$$

где M – молекулярный вес; ρ – плотность зародыша; q – теплота плавления; T_0 – равновесная температура двух фаз бесконечно большого радиуса.

Скорость образования критических зародышей записывается так:

$$J = K_0 E^{-W/kT}, \qquad (5)$$

где W – имеет смысл (4); множитель K_0 – термодинамически не определяется и разными авторами, на основе молекулярно-кинетического рассмотрения процесса, получены различные K_0.

Несмотря на различные модификации и уточнения классической теории зародышеобразования и ее вполне правильном качественном описании процесса зарождения центров кристаллизации, она все-таки далека от соответствия экспериментальных и теоретических данных. Это вызвано следующими обстоятельствами:

- теория построена на грубом допущении, что микроскопические скопления атомов обладают макроскопическими характеристиками и, в целом, равновесными термодинамическими параметрами;

- практически, во всех работах, посвященных начальной стадии зарождения новой фазы, образование метастабильной фазы считается мгновенным;

- теория (и ее модификации) содержит ряд параметров, не имеющих строго количественного решения.

Критический зародыш образуется последовательно в серии случайных актов присоединения и отрыва атомов (молекул) друг от друга. Поэтому зародышеобразование – случайный процесс во времени и пространстве. Это предопределяет вероятностный характер параметров, которые описывают кинетику образования зародышей. Количественное описание случайного процесса дается его функцией распределения, удовлетворяющей кинетическому уравнению. В общем случае кинетическое уравнение является сложным интегро-дифференциальным уравнением, решить которое невозможно. Однако, если рассматривать случайный процесс как марковский, то кинетическое уравнение переходит в дифференциальное уравнение, которое имеет более простой вид. В частном случае пуассоновского процесса гибели и размножения с конечным числом состояний получается система дифференциальных уравнений кинетики зародышеобразования (см. [2-5]):

$$\begin{cases} dp_0(t)/dt = -\lambda_0 p_0(t) + \mu_1 p_1(t), \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ dp_{\hat{e}}(t)/dt = \lambda_{\hat{e}-1}p_{\hat{e}-1} - (\lambda_{\hat{e}} + \mu_{\hat{e}})p_{\hat{e}}(t) + \mu_{\hat{e}+1}p_{\hat{e}+1}(t), \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ dp_n(t)/dt = \lambda_{n-1}p_{n-1}(t). \end{cases} \qquad (6)$$

Здесь λ_0 – вероятность перехода системы из состояния E_0 в E_1 и т.д.; μ_1 - вероятность перехода из состояния E_1 в E_0 и т.д. Вероятность перехода из E_n в E_{n-1} полагается нулю (μ_n=0), т.е. состояние E_n для такой системы - поглощающее; $p_i(t)$ - вероятность нахождения системы в состоянии E_i.

Система уравнений (6) является системой уравнений Колмогорова [6]. Общее решение настолько громоздко, что не позволяет провести анализ даже численными методами. Приведенный выше пример показывает, что большинство исследователей идет по пути решения уравнений диффузионного типа, математическая теория которых разработана достаточно полно (например, [7, 8]) и которые описывают процесс случайных блужданий, а также теории надежности, порядковых статистик, массового обслуживания и ряд других).

К числу основных кинетических уравнений, вытекающих из дифференциальных уравнений Колмогорова, для случайных марковских процессов относятся уравнения Смолуховского-Чепмена и Фоккера-Планка. При многомерном векторе q, уравнение Фоккера-Планка имеет вид [9]:

$$\frac{\partial f}{\partial t} = -\sum_j \frac{\partial}{\partial q_j}[K_j f] + \frac{1}{2}\sum_{j,\hat{e}} Q_{j\hat{e}} \frac{\partial^2}{\partial q_j \partial q_{\hat{e}}} f. \qquad (7)$$

Получить решение уравнения (7) в явном виде удается лишь в частных случаях, например, если величина K линейна по переменным q, а величина Q_{jk} не зависит от q. Уравнение (7) имеет важную роль в нестационарной теории замедления нейтронов [10], однако его линеаризация приводит к тому, что его решение сводится к отысканию соответствующей функции Грина при различных граничных условиях.

Для решения стохастических дифференциальных уравнений диффузионного типа, к которым также относятся уравнения (6) и (7), развито несколько подходов, из которых необходимо отметить подходы Ито [11] и Стратоновича [12]. Решая записанные для процесса Маркова y(t) стохастические уравнения типа Ланжевена, можно находить соответствующие ему нестационарные или стационарные моменты и корреляторы, одновременные или многовременные [12] стохастические уравнения Ито [11]:

$$\dot{y}_\alpha = f_\alpha(y) + \sum_s \sigma_\alpha^{(s)}(y)\xi^{(s)}(t), \quad (8)$$

где $\zeta^{(s)}(t)$ - дельта-коррелированные по времени случайные функции, имеют недостатком то, что с входящими в него выражениями типа $\sigma(y)\zeta(t)$ при различных выкладках нельзя обращаться по обычным правилам, пригодным для гладких функций. Это обстоятельство неудобно с практической точки зрения. Обычные правила преобразования можно применять к стохастическому уравнению Стратоновича [12]:

$$\dot{y}_\alpha = q_\alpha(y) + \sum_s q_\alpha^{(s)}(y)\xi^{(s)}(t), \quad (9)$$

записанному в симметризованном смысле. При этом уравнение (9) понимается так: сначала мы записываем его для δ_ε-коррелированной аппроксимации процессов $\zeta^{(s)}(t)$, а затем в этом уравнении переходим к пределу $\varepsilon \to 0$, что дает нам уравнение (8).

Отметим, что оба подхода до настоящего времени пока еще не нашли своей реализации в теории зарождения кристаллов. Например, в работе [13] сказано, что «изучение образования новой фазы привело к созданию общего метода описания кинетики фазового перехода первого рода, в котором рост макроскопического зародыша стабильной фазы «… обычно сводится к решению одномерного уравнения Фоккера-Планка…». Подобный подход был использован и в работе [14]. Однако, одномерное уравнение Фоккера-Планка приводит к отсутствию флуктуаций, что противоречит самому понятию образования зародышей за счет флуктуаций.

В работе [15, гл.9] показано, как легко и просто получать интегралы по траекториям, уравнения Фоккера-Планка и Ланжевена-Ито. Однако, как мы отмечали выше, получить решения этих уравнений для реальных случаев бывает очень трудно.

В заключение отметим следующее:

- формальный вероятностный характер описания процесса зародышеобразования как случайного марковского стационарного процесса или одномерных уравнений Фокера-Планка требует более строгого обоснования, поскольку ряд предположений (отсутствие последействия, ординарность и др.) не вытекает из физической картины явления;

- так как экспериментально наблюдаемыми являются (как и в квантовой теории) не сами функции распределения, а их моменты и корреляторы, то целесообразно проведение анализа статистических закономерностей начальной стадии зародышеобразования, используя подход Стратоновича [12];

- интересные результаты можно получить, используя синергетический подход [15].

В 80-е годы прошлого столетия исследователей привлекло необратимое объединение частиц в кластеры – задача, аналогичная отмеченной нами выше. Стало понятно, что именно кластеризация является одним из способов возникновения фракталов в необратимых процессах. Виттен и Сандер [16] предложили модель такого рода – модель диффузионно-ограниченной агрегации (ДОА), ставшей предметом интенсивных исследований [17-20]. Модель очень проста: совершающие случайное блуждание частицы в результате аккреции (присоединения) образуют кластер, приходя по одной издали и присоединяясь либо к точечному центру кластеризации, либо к ранее аккретитировавшим частицам. Интенсивные компьютерные исследования показали, что в результате такого процесса образуются сложные разветвленные фракталы. В [16] выделено три динамических режима: 1) режим, близкий к равновесному; 2) образование структур и 3) хаотический режим. При этом диффузию скрытой теплоты от растущего кристалла отождествляют с движением случайно блуждающих частиц к кластеру. Неравновесный кристалл, по мнению авторов [16], форма которого определяется построением Вульфа, соответствует режиму (1). Формы снежинок соответствуют режиму (2). Неупорядоченный хаотический рост кристалла, отождествляемый в [16] с ДОА, доведенный до конечного предела, служит примером (3). Наиболее известным экспериментальным примером ДОА является электролитическое осаждение металлов на электрод [17]. Описание роста кристаллитов осуществляется с помощью стационарного уравнения диффузии для плотности ионов U(r, t) с поглощающими граничными условиями:

$$\nabla U(\vec{r}, t) = 0. \quad (10)$$

$$U/S = 0 + \text{обрезание} \quad (11)$$

дополненными условиями роста на границе:

$$V_n \sim n\nabla U/S, \quad (12)$$

где V_n - нормальная скорость роста частицы на границе.

Используя величину V_n, задаваемую соотношением (12), удалось показать численным моделированием, что упомянутый выше процесс эквивалентен ДОА. В следующей статье работы [16] Сандер предложил континуальную ДОА. Вместо (10)-(12) было предложено формулировать задачу в терминах движения поверхности раздела, подпитываемой случайно блуждающими частицами, и переписать уравнения в виде:

$$\nabla^2 U = 0. \quad (13а)$$

$$V_n = -n\nabla U\,|\,S/4\pi. \quad (13б)$$

$$U(R_0) = 0, \quad (13в)$$

$$U(X_S) = 1 - \chi(X_S), \quad (13г)$$

$$U(X_{\text{âíóòð.}}) = 1. \quad (13д)$$

На большом расстоянии R_0 поле U поддерживается равным нулю; внутри области, ограниченной поверхностью раздела, оно равно единице; $\chi(X_s)$ означает кривизну поверхности раздела в точке X_S; V_n - нормальная скорость поверхности раздела. Форма обрезания соответствует задаче о вязких пальцах, но пригодность ее в рамках модели ДОА сомнительна, поскольку граничное условие при численном моделировании на основе ДОА включает только обрезание на малом расстоянии, соответствующем размерам частиц. Но какое-то об-

резание необходимо - в противном случае возникнут нефизические условия. Решать уравнения (13) прямыми методами сложно. Однако позже было показано, что более эффективное решение может быть достигнуто путем перехода к итегро-дифференциальному уравнению:

$$1+(4\pi)^{-1}\int dX_S\chi(X_{S'})\partial G(X_S,X_{S'})\Big/\partial n'=\int dX_{S'}G(X_S,X_{S'})\vartheta(X_{S'}), \quad (14)$$

где G(x,y) – функция Грина для двумерного уравнения Лапласа. Интеграл в левой части уравнения (14) – потенциал двойного слоя величины – $\chi/4\pi$, создающий скачок поля от 1 до 1-χ(Xs) на поверхности раздела. Численно решая (14), можно получать фрактальные структуры. За последние годы в теоретическом плане в ДОА существенных изменений не произошло [13, 14, 17-20]. Отметим теперь следующие обстоятельства: модель ДОА не выходит за рамки теории марковских процессов, о которой мы говорили выше, тем более что марковские ветвящие процессы, в принципе, описывают сложные ветвящие структуры; уравнения ДОА (4.10)-(4.12) и (4.13) неприменимы к начальной стадии агрегации из-за неопределенности в определении поверхности «одной» или «двух» частиц и т.д. и ее кривизны, а также из-за «сильной» нестационарности начального процесса агрегации; имеются серьезные возражения в отношении граничных условий, не вытекающих непосредственно из физической картины явления.

Таким образом, фрактальные модели, в том числе и ДОА, мало пригодны для описания начальной стадии образования центров кристаллизации. Однако они очень полезны для моделирования многих последующих стадий роста кристаллов.

Здесь мы хотим продемонстрировать одну простую модель, которая дает некоторые физические представления о процессе гомогенного зародышеобразования. В однородной среде с плотностью числа частиц n вероятность W(r) того, что ближайший сосед находится на расстоянии r_K от выбранной частицы, нетрудно получить из классической статистической физики, и она равна:

$$W(r_{\hat{e}})=4\pi n r_{\hat{e}}^2\exp\left[-4\pi n^2 r_{\hat{e}}^3/3\right]. \quad (15)$$

Вероятность нахождения N частиц в зародыше радиусом $r_к$ равна, очевидно, $W_N(r_{\hat{e}})=\prod_{i=1}^{N}W_i(r_{\hat{e}})$. Вероятность (15) мы определим, с другой стороны, как отношение энергии боровского атома $\left(E=z^2/2a,\ z-çàðÿä,\ à=const\right)$ к полной энергии системы (идеальный газ) $\left(3/2nkT_0\right)$. Это сделано для того, чтобы качественно оценить, будет ли отличаться критический радиус зародыша $r_к$, например, для различных металлов? Таким образом, мы имеем

$$\frac{z^2/2a\cdot N}{3/2\,nkT_0}=(4\pi n)^N r_{\hat{e}}^N\exp\left[-4\pi N n^2 r_{\hat{e}}^3/3\right]. \quad (16)$$

Логарифмируя обе части (16) и проводя несложные преобразования, получим:

$$-9\ln 10+\ln\left(\lambda\frac{Z^2}{T_0}\right)+\frac{3}{2}n\frac{T_0}{\Delta T}=\frac{4\pi}{3}Nn^2r_{\hat{e}}^3. \quad (17)$$

Здесь первый член возникает при подстановке констант, α=1 - обеспечивает единую размерность величин, T_0 – температура плавления, $\Delta T=T_0-T_1$ - переохлаждение. Из (17) видно, что первые два члена слева пренебрежимо малы по сравнению с остальными. Это сразу убирает зависимость $r_к$ от Z, т.е. от вида атомов кристаллизующегося вещества. Окончательно из (17) имеем:

$$N\cdot r_{\hat{e}}^3=\frac{1}{\pi n}\cdot\frac{T_0}{\Delta T}. \quad (18)$$

Если сделать оценку по средним величинам: $r_к$ ~ 1 нм, T_0 ~ 1000 (для металлов), ΔT ~ 100, n = N_L – числу Лошмидта ~ $3\cdot10^{19}$ $см^{-3}$, то мы получим для числа частиц в зародыше N ~ 100. Ниже мы приводим данные, взятые из работы [21]. Видно, что наши оценки по формуле (18) качественно согласуются с экспериментальными данными. Действительно, радиус $r_к$ зародыша практически не зависит от вида атомов металла, среднее число N частиц в зародыше имеет один порядок.

Таблица 1.

Параметры кинетики зародышеобразования при кристаллизации переохлажденных металлов [21]

Металл	T_0, К	ΔT, К	$r_к$, нм	N
Ртуть	234	90	0,8	100
Олово	505	180	0,8	130
Висмут	544	200	0,8	30
Свинец	600	170	1,1	180
Германий	1210	295	0,9	130
Серебро	1234	253	1,2	430

Из (18) следует, что в правой части стоят параметры, величину которых не изменишь в широких пределах, т.е.

$$N \cdot r_{\hat{e}}^3 \approx \text{const} . \qquad (19)$$

Соотношение (19) приближенно выполняется для многих веществ. Глубокие причины подобных корреляций пока еще не ясны.

Из приведенного выше краткого обзора процесса зародышеобразования следует, что в этом направлении необходимы как теоретические, так и экспериментальные усилия для выяснения многих вопросов, часть из которых отмечена нами выше.

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SOCIAL SCIENCIES

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THEORY OF MASS COMMUNICATION

Ezhanova G.
Atyrau University named after Kh.Dosmukhamedov
Academic Supervisors: Abdol E.D., Khismetova G.N.
DOI: 10.5281/zenodo.7994908

Abstract
Currently, Kazakhstan is intensively introducing new information and communication technologies (ICTs), increasing competition from foreign media, and gradually switching to new standards for TV and radio companies, telecom operators, and digital broadcasting in the country.

Keywords: *New media, Mass media.*

Information processes are global in nature, but have national characteristics of the emerging state. With the acquisition of sovereignty in Kazakhstan, a new system of mass media was formed. De-monopolization of the telecommunications and broadcasting sectors has been implemented. The emergence of new media organizations, private and joint-stock media, and TV and radio companies has made it possible to quickly and easily enter the media market, constantly feeling the need for information resources and messaging.

Currently, the mobile telephony market is actively developing in the country. The Ministry of Transport and Communications of the Republic of Kazakhstan is actively working to introduce the 3G cellular communication standard in the territory of the Republic. By the beginning of 2012, there were 24 million mobile subscribers in the country (the population of Kazakhstan as of May 4, 2012 was 16.73 million people).

Internet users are growing rapidly in Kazakhstan. So, from 2000 to 2009, the number of Internet users in Kazakhstan increased from 70 thousand to 2.3 million people (increased 30 times). By 2010, the number of Internet users was 3.5 million. At the beginning of 2012, there were 8.7 million Internet users in the country.

Currently, new media, in particular social networks, are rapidly developing all over the world, and Kazakhstan is no exception. Facebook is one of the most frequently used social networks in the world and the most frequently used query in the Google search engine. As noted by the Executive Director of the company" Intenews-Kazakhstan "M. Yelshibayeva, " if Russian Internet users like such social networks as Odnoklassniki and Vkontakte, Kazakhstanis prefer Facebook and My World. In addition, Kazakh is one of the four most frequently used languages on Facebook. (1).

The first cable TV networks in the country began to be created in the late 1980s. Currently, 146 cable TV operators provide cable TV services in the republic, mainly in regional centers and major cities of the country. The country is rapidly developing a cable television system, where subscribers of this type of broadcasting are offered more than 100 channels. In March 2003, the Association of Cable TV Operators was established in Kazakhstan. The main cable TV players in Kazakhstan are:

- Alma-TV JSC,
- Alem Communications Holding, which includes Digital TV networks (Almaty), G-Media (Pavlodar), Sekatel (Aktau, Astana, Almaty) and 5 other companies in the cities of Taraz, Aktau, Zhanaozen, Uralsk, Aktobe.
- tv icon,
- Kazakhtelecom and iDTV.

According to experts, the pay TV market in Kazakhstan is growing by 15-20 percent annually.

Kazakhstan is actively implementing new information technologies in the mass media. A large territory of the country contributes to the development of satellite television-television without borders. Kazakhstan's Baikonur cosmodrome, a space rocket launch center, provides great assistance in this direction. Thanks to the Zharyk satellite TV system, it became possible to broadcast TV programs from the Northern and southern capitals to all regions of Kazakhstan, as well as TV programs from some countries of Russia, Uzbekistan, China, and Mongolia. peripheral broadcasting.

In July 2011, the second Kazakh satellite "Kazsat-2" was launched, providing the republic with satellite communications, as well as digital television and radio broadcasting. This satellite is intended for domestic broadcasting and telecommunications. And with the launch of Kazsat-3 in 2013, the republic will not depend on foreign telecom operators. For the creation of the third satellite in 2011-2013, Kazakhstan will allocate 24 billion tenge (2) (1 ruble = 4.6 tenge, 1 dollar = 149 tenge).

Currently, the state program "Electronic Government" is being implemented, approved by the Decree of the President of the Republic of Kazakhstan dated November 10, 2004. Its goal is to create a corporate information system throughout the country. It consists of two stages: the first one is informative and the second one is interactive. An e-government web portal has been launched as a single window, bringing together all the Internet resources of government agencies.

Kazakhstan has started developing 6 national websites. The first is the national educational website,

which hosts electronic textbooks for schoolchildren and students. The second is the first national medical web portal for a wide range of users. There will be a project of the electronic library of Kazakhstan. A large portal "National heritage of Kazakhstan" is planned, containing information about the history, culture, ethnic group of Kazakhstan, its peoples. There will be two more portals: a portal for legal entities and a business portal that reveals the country's business potential.

The most important priority for Kazakhstan is the country's transition to digital broadcasting by 2015, which is due to global trends – the transition period of the International Telecommunication Union "Geneva-2006 "(2007-2015).) introduction of digital television broadcasting in coordination with broadcasting. Kazakhstan has developed a state program for the development of digital television and radio broadcasting in the Republic of Kazakhstan for 2008-2015. Its implementation requires the allocation of funds from the national budget, as well as extra-budgetary sources: direct domestic and foreign investments totaling 36.165 million tenge (3).

On July 3, 2012, Kazakhstan launched a digital terrestrial TV broadcasting network in the cities of Astana, Almaty, Karaganda, Zhezkazgan and Zhanaozen. In total, the network includes 827 radio and television stations. DVB-T2 broadcast standard with CUD. Two multiplexes equivalent to 30 SDTV channels are broadcast in Astana, Almaty and regional centers, and one multiplex of 15 TV channels is broadcast in other localities. The construction of the digital terrestrial television network is scheduled to be completed in 2015. The national TV and radio broadcasting operator Kazteleradio JSC provides parallel operation of the existing analog broadcasting network.

To increase the competitiveness of domestic television production, it is planned to create a global multisegment broadcasting network, which provides for the appearance of the largest news agency in Central Asia. The Ministry of Communications and Information of the Republic of Kazakhstan (now the Ministry of Culture and Information of the Republic of Kazakhstan) opened a new TV and Radio Complex in Astana in December 2011. Currently, the draft law "On TV and Radio Broadcasting" has been approved, which regulates issues related to digital broadcasting, as well as other issues of great importance for the development of the industry.

If in 1990 there were only two national TV channels in the republic, then 4 radio programs and about 400 magazines and newspapers were published. Currently, more than 7 thousand people are registered. Mass media, of which 3,018 mass media operate on a permanent basis. The share of print media (newspapers and magazines) is 91% of the total number of mass media, electronic media - 8.5%: 63 TV channels and 42 radio companies, 146 cable TV operators and 6 satellite broadcasters, 0.5% - news agencies.

The share of non-State media in the country's information market is 85 percent. The largest contribution among print media:

- social and political publications-36%,
- information -32%,
- scientific and analytical -27%.

Almost half of the total number of newspapers is published in Kazakh and Russian, there are newspapers published only in Kazakh or only in Russian, some newspapers are Uyghur, Korean, English, German, etc. Foreign news agencies are accredited in Kazakhstan: ITAR-TASS, RIA Novosti, Reuters, Franz-Press, Xinhua, etc.

Since 2005, funding for supporting ethnic media and demonstrating interethnic relations has been increased more than 4 times. In Kazakhstan, newspapers and magazines are published in 15 languages, radio programs-in eight, TV programs-in 11 languages, the state allocates funds to support the activities of 19 ethnic media outlets, a total of 33 (4).

Electronic media coverage in the country is provided by 11 TV channels and 5 radio stations. Programs at the national level: Khabar TV channels – 98.19%, Kazakhstan-98.06%, El-Arna – 83.58%, First Channel Eurasia-78.82%, Kazakh Radio-93.2%. There is a satellite channel "Caspionet", which broadcasts in Central Asia, the Middle East, Europe and North Africa. In 2011, Caspionet began broadcasting in the United States, and its programs also became available in America (5). Rural localities are mainly covered by the state-owned Khabar, Kazakhstan, and El-Arna channels.

Non-governmental republican TV and radio companies broadcasting at their own expense on a large territory of the republic: KVN, NTK, Channel 31, STV, Radio Russia Asia, Europe plus Kazakhstan, Radio NS.

About 2,400 foreign media outlets, including 2309 newspapers and magazines, 83 TV and radio programs, are distributed on the domestic Kazakh information market. More than 80 foreign media outlets are accredited in Kazakhstan. About 90% of the total number of foreign media titles distributed on the territory of the republic in Russian, 5% - in English, 5% - in other languages of the world.

The largest foreign media distribution networks in the republic: Kazpost JSC, AiF-Kazakhstan Joint Venture LLP, Eurasia-Press JSC, Alma-TV JSC, Sekatel LLP, Kazcenter-TV, Katelko+. The total volume of mass media distributed by these structures is 70 percent of the total volume.

Kazakhstan was the first among the Central Asian states in the CIS to start broadcasting using advanced technologies using digital television, a multimedia satellite system for transmitting a television signal and live television broadcasting.

Today, the leading role in the country is played by computerized information communication networks, which are introduced into our lives in different directions, within individual states, regions, and at the transnational level, forming a wide network of connections, whose services are often compared. functions of the nervous system.

The information technology revolution has strengthened the introduction and development of global QMS, satellite, cable TV, mobile telephony are rapidly spreading in the republic, the number of web publications, information multimedia resources is growing, fiber-optic communication and paid video are developed. Socio-economic changes in Kazakhstan's

society have determined the direction of development of new information technologies and mass media in the country.

The trend of preparing national broadcast programs that can compete with international programs is becoming more and more noticeable, the launch of its own communication satellite provides direct television broadcasting throughout the country, specialized cable television services are being created, digital and interactive broadcasting is gradually being introduced, and the Internet is actively developing.

The politically strong trend towards deregulation, the country's openness to expanding the perception of global messages, and the commercialization of television systems contribute to accelerating integration processes, which, in turn, increases the competitiveness of new participants in the information market.

The creation of a market for information services, the emergence of various operators, networks of communication firms, and new TV and radio channels in Kazakhstan are factors that influence the prospects for the development of modern media in the country. Modernization of a number of countries and regions can be successful if the society retains its uniqueness in the context of communication and economic globalization with the active development of new information technologies and the latest mass media.

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TECHNICAL SCIENCES

USING DIGITAL FILTERS OF GNSS-MONITORING DATA IN THE PORTABLE APPLICATION "STAMM"

Manyashin A.V.
PhD in engineering
Tyumen Industrial University
Russian Federation, s. Tyumen, Volodarsky 38
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Abstract

GNSS monitoring has become widespread in transport, significantly increasing the efficiency of its use. Moreover, the data received through communication channels, as a rule, is stored by online services and can be further used to solve a variety of tasks. Monitoring service providers provide an opportunity for users to freely upload reports generated on the basis of monitoring. However, the use of this data comes with a number of limitations. First of all, this is due to errors in determining the current speed of the car, which is due to the peculiarities of satellite navigation technology. Therefore, monitoring data are subject to preliminary processing in order to exclude or correct anomalous observations caused by measurement error. The portable application "Stamm" presented in the article contains tools for smoothing incorrect measurements.

Keywords: digital filters, driving cycles, satellite monitoring, GPS-Glonass navigation

Introduction

The processing of GNSS online monitoring data (Global Navigation Satellite System includes the collection, analysis and interpretation of information received from satellite navigation systems. This is mainly information about the coordinates and speed of objects, tied to the exact time counts. The reverse channel of the system also provides for the transmission of arbitrary data. This may be data from various sensors related to the technological process of the object of monitoring.

Specialized programs and algorithms are used to process GNSS online monitoring data, which allow you to accurately determine the coordinates of objects and monitor their movement. This is important for many industries, such as transport, geodesy, construction, etc. Processing GNSS online monitoring data is a necessary tool for accurately determining the location of objects and monitoring their movement. This makes it possible to increase work efficiency, improve safety and reduce the cost of transportation and other operations.

Methods of correcting the error of GNSS navigation

To ensure high accuracy of GNSS online monitoring data, correction methods are used to eliminate errors and distortions that occur during data transmission and processing. Some of these methods include:

1. Signal correction: This method is used to eliminate errors associated with signal distortion during its transmission through the Earth's atmosphere. For this purpose, data on the state of the atmosphere obtained with the help of additional instruments are used.

2. Differential correction: This method is used to eliminate errors related to various factors, such as multipath propagation of the signal and incorrect location of satellites. For this purpose, data obtained with the help of additional receivers at nearby points is used.

3. Carrier frequency phase correction: This method is used to eliminate errors related to the phase change of the carrier frequency during its transmission through the Earth's atmosphere. For this purpose, data on the state of the atmosphere obtained with the help of additional instruments are used.

4. Ephemeris correction: This method is used to eliminate errors related to the incorrect location of satellites at the time of signal transmission. For this purpose, data on the exact location of satellites obtained with the help of specialized stations are used.

All these correction methods make it possible to increase the accuracy of the GNSS data of online monitoring and provide more reliable control over the movement of objects.

The error in determining the coordinates of GPS (Glonass) systems can be caused by various factors, such as:

1. Signal distortion during transmission through the Earth's atmosphere, which may lead to inaccuracies in determining the distance to the satellite.

2. Multipath propagation of the signal, when the signal is reflected from various surfaces and reaches the receiver with a delay, which can also lead to inaccuracy in determining the distance to the satellite.

3. Incorrect location of satellites, which may lead to inaccuracy in determining the coordinates of the object.

4. Errors in ephemerides that describe the exact location of satellites at the time of signal transmission.

5. Incorrect receiver setup or data processing.

To eliminate these errors, the correction methods described above are used. It is also important to choose the location of the receiver, taking into account the minimization of possible interference and signal distortion.

Thus, the accuracy of determining coordinates and speed using GNSS navigation depends on several factors, such as the number and location of satellites, the quality of the receiver and error correction methods. Glonass and GPS systems ensure the accuracy of determining coordinates at a level from several meters to

several tens of meters, depending on the number of satellites used and signal reception conditions. In terms of speed, Glonass and GPS systems allow you to determine the speed with an accuracy of several meters per second. However, additional sensors such as speed sensors, accelerometers, and gyroscopes can be used to measure speed more accurately. In general, the accuracy of determining coordinates and speed is quite sufficient to control the mode of operation of vehicles. However, the extensive database of high-speed profiles of cars formed during the monitoring process can also be used for scientific research. For example, to determine typical speed profiles or driving cycles of cars and special equipment [1-6].

When using the monitoring database, it is necessary to take into account data stream compression algorithms when storing information about the speed of vehicles on GNSS online monitoring servers, they are used to optimize the use of data storage and reduce the load on the network and reduce the amount of data transmitted without loss of information quality.

One of these algorithms is the delta coding algorithm, which is based on preserving the difference between successive values of vehicle speed. This allows you to reduce the amount of data transmitted if the speed of the vehicle does not change significantly. Another algorithm is the Huffman algorithm, which is used to compress text data. It can also be applied to vehicle speed data if this data is presented as text strings.

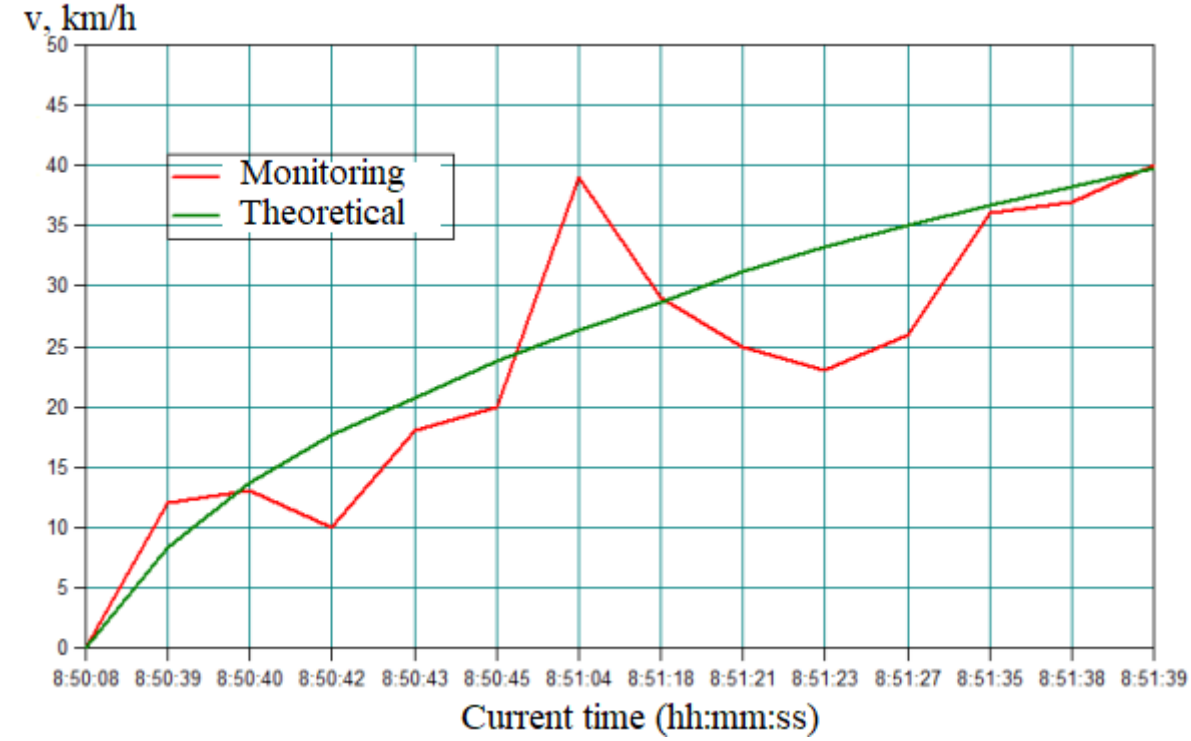
Data compression algorithms such as LZ77 and LZ78 can also be used, which are based on finding duplicate fragments in the data stream and replacing them with references to previous occurrences. This reduces the amount of data transmitted if the speed of vehicles is repeated at certain time intervals.

However, if there is an error in determining the current coordinates using GNSS for the reasons noted above, the use of stream compression algorithms can multiply this error. But even the speed profiles obtained with the minimum speed update frequency of one second at the moment require pre-processing. (Pic. 1), and it can be both positive and negative.

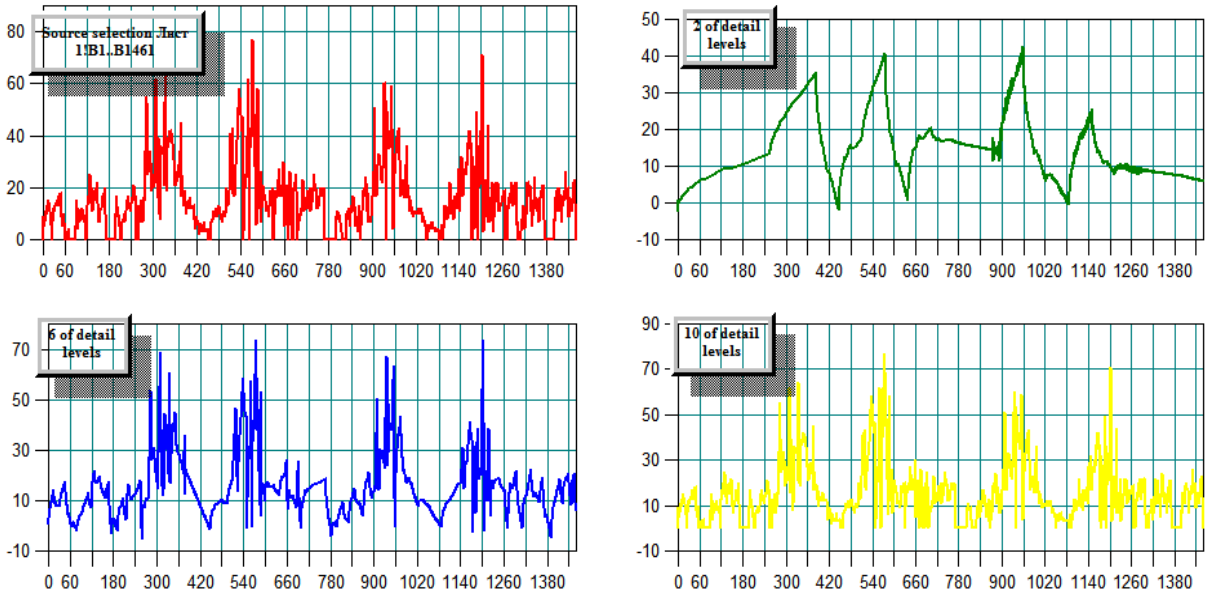
The figure shows jumps in the calculated speed values relative to the assumed real ones. Thus, smoothing of numerical values is necessary to eliminate outliers.

Correction of the initial monitoring data

To do this, you can use data coarsening using spectral data analysis tools, for example, compare the source data from the GNSS monitoring server (Pic. 2 at the top left) and the data obtained using the Wavelet transform (Pic. 2 at the bottom left) available in the Stamm 4.2 program [2, 7]. It is obvious that the approximation of GNSS monitoring data with a given detail makes it possible to smooth out emissions over the entire field of the velocity profile.



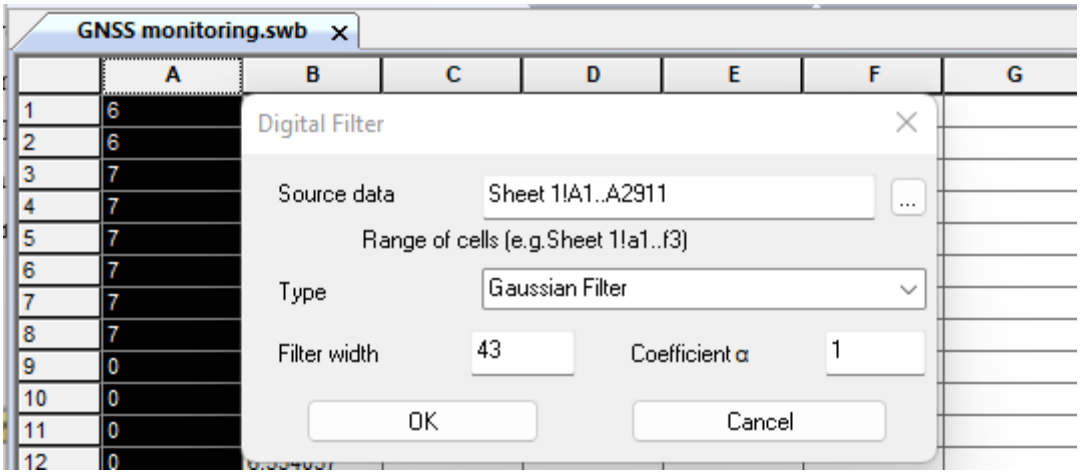
Pic. 1. The curve of the speed change during the acceleration of the car



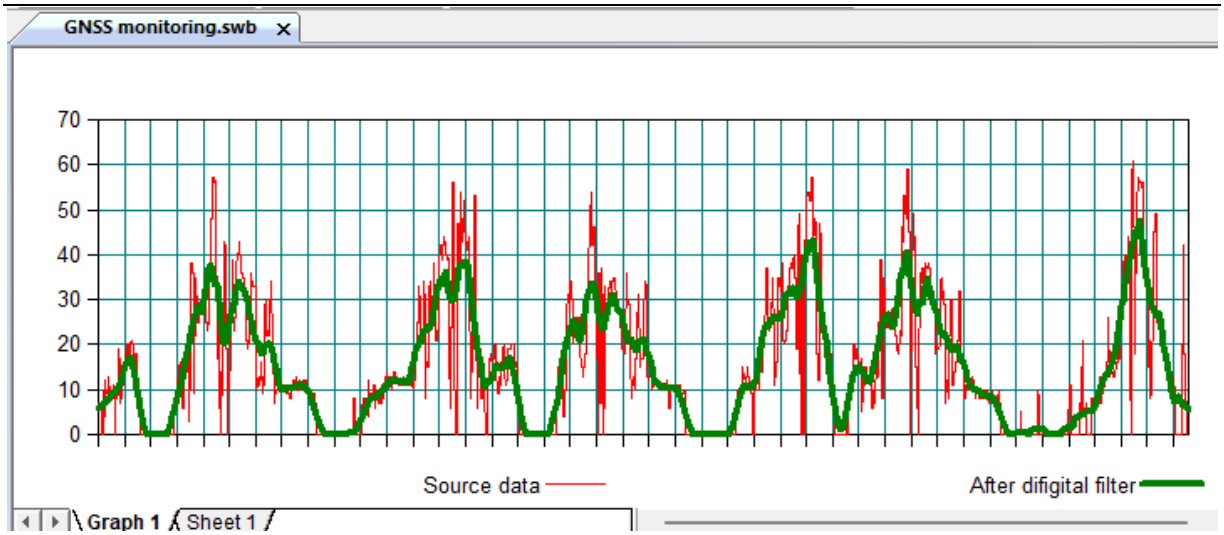
Pic. 2. A velocity profile subjected to a Wavelet transform. Stamm 4.2

However, the approximation of the entire velocity curve at once, as a rule, does not completely eliminate the errors caused by the imperfection of the coordinate determination technology (Pic. 3). In the figure, you can see that there is a presence of negative values in the data smoothed by this method. In addition, to restore the data processed using the wavelet transform, additional computing power costs associated with a large number of coefficients of theoretical dependence comparable to the size of the original sample are required. The features of the wavelet approximation also impose strict restrictions on the sample size.

In the latest version of the program, the author added the function of digital filters. In fact, this is also an approximation, but performed on a narrow area determined by the width of the filter. The difference lies in the fact that the application of the filter "replaces" incorrect data and you can get a corrected selection, for example, in the adjacent column of the workbook of the Stamm program. By controlling the type of digital filter and its settings - width and coefficients, you can achieve the desired degree of "correction" of the data (Pic. 3). The effect of the filter on the original sample can be estimated using the graph obtained in the appendix (Pic. 4).



Pic. 3 Applying a digital filter to the original sample



Pic. 4 Application of a digital filter with a window width of 43

Results and discussion

The use of digital filters allows you to clear the initial sample received from the GNSS monitoring server from abnormal values, the type of filter and its settings should be determined based on the data compression algorithms used on the server and the quality of GPS equipment, Glonass terminals. The given example of data correction made it possible to achieve almost complete compliance of the "Stop" phase with real traffic conditions.

Conclusions

The proposed methods and approaches for processing experimental data obtained by exporting reports from GNSS monitoring servers will improve the quality of the sample and remove anomalous observations that distort the studied patterns. In addition, the use of digital filters does not require further reuse of computer computing power. An important feature of the Stamm application, along with the noted functions of preprocessing, data analysis and visualization, is its mobility. The program does not require the installation and use of any additional libraries or files, since it is a mobile application capable of being executed from any available medium [7].

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INFLUENCE OF INOCULANTS ON THE FEATURES OF WELD STRUCTURE FORMATION IN LOW-ALLOYED STEELS (REVIEW)

Holovko V.V.
E.O. Paton Electric Welding Institute of the NASU 11 Kazymyr Malevych Str., 03 150, Kyiv, Ukraine
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Abstract

The paper presents a review on the influence of dispersed refractory compounds inoculation into the weld pool on weld metal microstructure formation in low-alloyed high-strength steels. Primary structure formation process features are considered in the refractory nonmetallic inclusions presence in the liquid metal, as well as on the interface of δ-dendrites and γ-phase. of The inoculant influence possibilities on the bainite transformations temperature range, microstructural components formation with higher brittle fracture resistance, and weld metal toughness values improvement are shown.

Keywords: low-alloyed steels, welding, structure, inoculants, 5-dendrites, austenite. bainite

Introduction

High strength low-alloyed (HSLA) steels have become widely accepted in fabrication of welded metal structures. Owing to application of special welding technologies and selection of appropriate welding consumables, welded joints of these steels are capable of providing high values of strength, ductility and toughness. Numerous studies were published in recent years in special literature devoted to the problems of formation of metal microstructure in welded joints of HSLA steels. Particular attention is paid here to the role of bainitic components of weld microstructure. Numerous studies, considering bainite initiation and growth in BCC iron alloys are indicative of the fact that the features of the process of formation of this microstructure are still not quite clear. To date two main mechanisms of *y-> a* transformation in iron alloys have been quite well studied and described, namely the diffusion and the shear mechanism. Diffusion mechanism occurs at temperatures close to *A* . It is described by the process of carbon redistribution between y-(austenite) and a-phase (ferrite) and realized as pearlite transformation. The shear mechanism takes place at temperatures close to A_{ct}, it runs almost instantly and is realized in the form of martensite transformation. The complexity of description of the mechanism of intermediate transformation (bainite) consists in that it involves both these processes. There is a quite large number of factors, which determine the priority of this or that mechanism during bainite structure formation. This is exactly why the bainite structures are characterized by a considerable quantity of morphological forms (upper, lower, globular, acic- ular, lath, lamellar, intragranular, polyhedral bainite, etc.). Depending on the kind and composition, each of these structures has its values of strength, ductil ity and toughness. Formation of a particular kind of bainite in the weld metal has a significant influence on the mechanical properties of welded joint as a whole, so that a more profound understanding of the features of the processes of bainite initiation and development requires further investigations in order to expand our knowledge base on this subject.

The main alloying element, used in HSLA steels to increase the strength values, is carbon. Increase of the content of carbon (precipitating with formation of carbides) promotes steel hardening. Carbides, however, also lower brittle fracture resistance of the metal. To improve the steel strength, it is necessary to increase its carbon content, and, thus, more efforts are required to slow down carbide formation and their refinement. Well-known is the difference in carbide distribution between bainite, which forms at high or at low temperatures, i.e. between the intergranular and intragranular ones, respectively. In the upper region of bainite transformation, when the effectiveness of carbon diffusion in the solid solution is quite high, a considerable quantity of carbon has enough time to go beyond the grains, reach the boundaries, and precipitate in the form of carbides, while the ferrite grains proper remain free from the carbide precipitates. In the region of lower temperatures of bainite transformation, the carbon diffusion rate decreases markedly. Slower carbon diffusion, associated with lower temperature of bainite transformation, enables a certain quantity of carbon to precipitate in the oversaturated bainitic ferrite. In this case, fine dispersion of lamellar carbides in the single-crystal variant forms inside the grains, although more than one variant of carbide precipitation can be observed. Thus, both the size of primary austenite grains and the temperature range of bainite transformation have a significant role during formation of secondary microstructure.

INFLUENCE OF INOCULANTS ON PRIMARY STRUCTURE FORMATION

In general, whole technologies of low-alloyed steel welding consist in forming a fine-grained ferrite structure in the weld metal. It is believed that it should be promoted by formation of fine-grained structure of primary austenite. It should be noted that there are a lot of disputes in publications on the influence of the size of primary austenite grains on bainite transformation. Some researchers believe that the fine size of austenite grains leads to faster growth of bainite, others believe that the small grain size reduces the probability of the real transformation, and some do not notice any changes in bainite transformation at reduction of primary austenite grain size [1—3]. Differences of opinion on this issue are largely determined by the fact that initiation, growth and decomposition of primary structure, on the one hand, are poorly amenable to direct investigation because of the high temperature and speed

of the processes, and on the other hand, because of a lack of experimentally confirmed physical values for description of thermodynamics and kinetics of the processes, as a perfect computer model of formation of primary structure of HSLA steels is not available. However, based on the considerations that development of metal microstructure, and of its mechanical properties, respectively, starts from formation and decomposition of the primary structure, the task of expanding our knowledge base on this question is highly relevant.

So far it is not possible to predict the size of austenite grain in the weld metal, as the factors, controlling the grain size, are by far not completely understood. The theory of grain growth envisages that nonmetallic inclusions, contained in the weld metal, should control the grain size through grain boundary blocking (Zener effect). Practice showed, however, that such an analogy is not justified, as austenite grains form as a result of 8-ferrite transformation, while Zener pinning-efifect describes blocking of the grain boundaries during their growth from the liquid phase. The driving force of grain growth is usually equal to just several Joules per mole, whereas the activation energy of austenite transformation from 8-ferrite grows

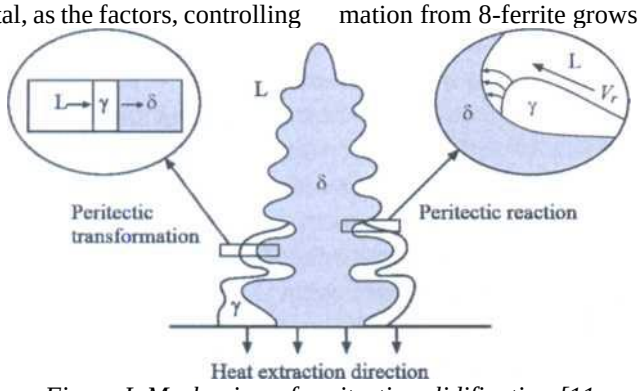


Figure I. Mechanism of peritectic solidification [11

unlimitedly at overcooling. In this case blocking of S/y interfaces cannot be effective. The mechanism of blocking the boundaries of columnar austenite grains does not agree with the shape of these grains, either, as the movement of S/y interfaces along the direction of the maximum temperature gradient has no obvious limitations. In this case, if the pinning process were effective, the austenite grains should be isotropic as a result of their forming. North et al. in work [4] presented a description of such crystallization. However, additional investigations are needed to clarify these issues. The size of columnar austenite grain should in a certain way correlate with grain size in the base metal on the fusion line, as solidification occurs through epitaxial growth of these grains [5]. This connection, cannot be simple, however, as during solidification those grains, where the crystallographic orientation coincides with (100) direction, are located in parallel to the direction of the highest temperature gradient. Such grains grow quickly and inhibit the growth of grains with another crystal lographic orientation. An experimental study, illustrating the influence of crystallographic texture on grain size [6], shows that nonmetallic inclusions located in the base metal (for instance, carbonitrides), can limit coarsening of weld metal grains on the fusion line and, thus, eventually result in smaller grain size in the fusion zone.

When considering the processes of primary structure formation, it is necessary to take into account the fact that they proceed at contact of the three phases and are described by peritectic reactions, respectively. Peritectic crystallization of metal at its cooling occurs in two stages. At the first stage a peritectic reaction proceeds in the point of contact of three phases (L-liquid + 8-ferrite + y-austenite) in the temperature range a little lower than the peritectic temperature, leading to separation of L-liquid and 8-ferrite with lateral growth of y-austenite around 8/L interface. At the second stage peritectic transformation begins with thickening of the layer of y-austenite at the expense of 8-ferrite phase and y-austenite tip advancing into the liquid L-phase (Figure 1). Development of high-tem- perature laser scanning together with the confocal microscopy [7] allows observation with a high resolution of phase transformations in the high-temperature region in peritectic steel. Results of these investigations [8, 9] showed that the peritectic transient process is controlled by diffusion of the solutes. It was found that partial remelting of 8-phase also is influenced by diffusion of solutes. It is shown that y-phase initiates and grows on the interface between 8- and L-phase, while y-phase quickly separates them in the process of growth. A conclusion was made that the interface enrichment in carbon is increased with increase of the cooling rate that decelerates initiation of y-phase. Moreover, it is shown [10] that the interface movement speed is influenced by elastic energy of the interface and coefficient of solute distribution

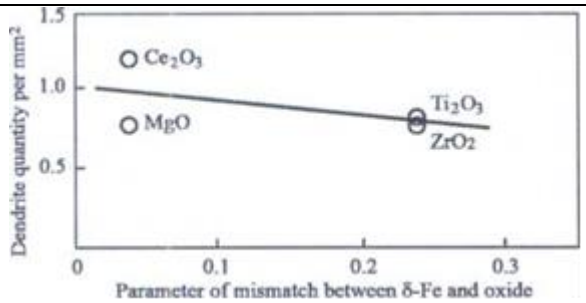


Figure 2. Dependence between the dendrite quantity and parameter of mismatch between 6-Fe and oxide [17|

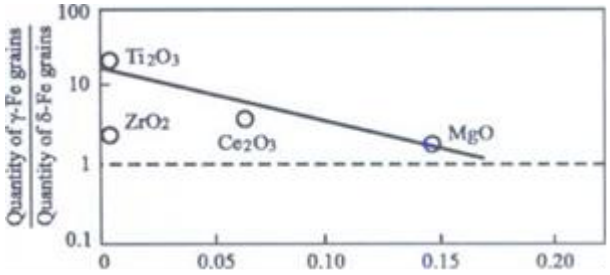


Figure 3. Dependence between mismatch parameter and density of y-phase nucleation centers on the interface with S-dcndrite [17]

Refractory inclusions with melting temperature above that of the metal melt, present in the thin layer on the surface of 8-dendrites, where y-phase initiates and develops, depending on the wettability index, can be absorbed by the growing phase or can accumulate on the interfacial front and influence the interfacial energy. Experimental results given in publications confirm this conclusion. So, work [12] shows the results of investigation of the influence of inoculation of such refractory oxides as MgO, ZrO,, Ti,0_3, Ce,0_3 into the steel melt. Determination of wettability index between the refractory oxides and liquid iron and S-Fe showed that the contact angle of wettability changes depending on time and temperature of contact. This is indicative of the possibility of interfacial reactions. From the viewpoint of thermodynamics, reactions with oxygen evolution can be in place at temperatures characteristic for steel pool melts [13, 14, 17]:

$Al_2O_3 \rightarrow 2Al + 3O$. $\Delta G° = 1225000 - 393.87T$ (J/mole),

$MgO \rightarrow Mg + O$. $\Delta G° = 89960 + 82.0T$ (J/mole),

$2TiO_2 = Ti_2O_3 + O$, $\Delta G° = 379908 - 97.069T$ (J/mole),

$3TiO_2 = Ti_3O_5 + O$, $\Delta G° = 387866 - 112.215T$ (J/mole).

It results in accumulation of decomposition products on 8—>y interface. As a result of the conducted studies, Bhadeshia et al. [15] came to the conclusion that increase of oxygen content in the steel melt does not affect the size of primary austenite grains, while authors of [16] express the idea that formation of y-phase is influenced by accumulation of alloying elements on the interface, for instance magnesium, as a result of MgO decomposition. The density of distribution of potential centers of new phase initiation depends on the energy on the initial phase boundary. The activation energy is primarily affected by increase of grain boundary energy, as a result of increase of the content of alloying elements on them. Increase of grain boundary energy will lead to increase of the speed of formation of new phase nuclei.

Experimental data given in publications confirm this conclusion. So, work [15] gives the results of studying the influence of inoculation of such refractory oxides as MgO, ZrO,, Ti,0,, Ce,0, into the steel melt. It was found that formation of solidification microstructure is influenced by chemical composition of the inclusions, as well as parameter of mismatch between y-Fe and oxide and 8-Fe and oxide (Figure 2).

Moreover, it is found that with increase of the parameter of mismatch between 8-Fe and oxide the quantity of y-Fe grains which formed in the body of one dendrite, becomes greater (Figure 3).

INFLUENCE OF INOCULANTS ON SECONDARY MICROSTRUCTURE FORMATION

Change of primary structure morphology by inoculation of dispersed refractory compounds before welding influences formation of weld metal secondary microstructure. Work [18] gives the results of investigations on adding refractory oxides, carbides and nitrides to the weld pool. It is shown that depending on physicochemical properties of the compounds, the inoculants influence the size of primary structure grains. Increase of primary austenite size should reduce the effectiveness of carbon diffusion that is confirmed by the change of temperature range of bainite transformation (Figure 4).

Lowering of bainite transformation temperature is accompanied by inhibition of carbon diffusion that causes carbide precipitation in the ferrite grain body, and by development of lower bainite structure in the weld metal (Figure 5) by deceleration of the processes of upper bainite and Widmanstatten ferrite formation. Change of microstructural composition results in improvement of weld metal toughness values (Figure 5).

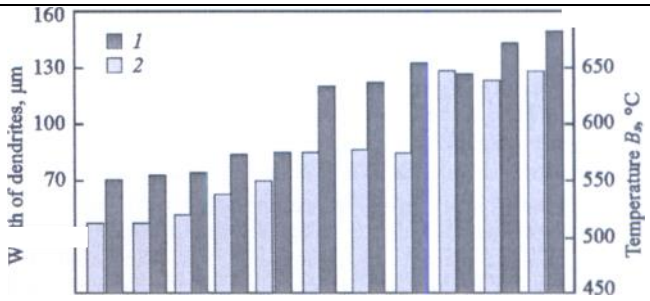


Figure 4. Influence of inoculation of refractory compounds on the change of dendrite size (/) and temperature of the start of bainite transformation B (2)

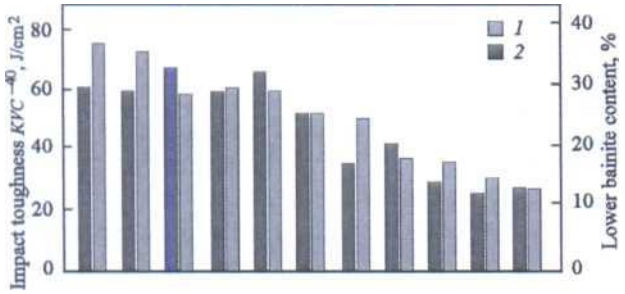


Figure 5. Influence of inoculation by refractory compounds on lower bainite content in the microstructure (/) and weld metal impact toughness (2)

Experimental results given in work [18] confirm the possibility of inoculant influence on weld metal structure. It is found that addition of dispersed particles of refractory compounds with the respective physicochemical properties to the weld pool allows changing the primary structure grain size, and promotes shifting of bainite transformations to lower temperature region. Increase of lower bainite content in the weld microstructure, owing to upper bainite and Widmanstatten ferrite, as a result of development of such processes, allows improvement of their mechanical properties.

CONCLUSION

Formation of weld metal microstructure takes place during a continuous process, which starts from initiation and development of primary structure and ends by formation of a secondary microstructure. Primary structure grain size depends on the energy of interfaces between 5- and y-phases, and it is determined by the effectiveness of carbon diffusion during y->a transformation. Inoculation of refractory compounds to the weld pool liquid metal enables influencing the processes of primary structure formation, temperature range of bainite transformation and formation of a secondary microstructure with higher content of lower bainite in the metal of HSLA steel welds

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