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# **Structure and properties of a carbamide composition with a metal complex hardener and activated fillers**

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**ABSTRACT:** Analytical information on the results of studies of the physicochemical and mechanical properties of carbamide-formaldehyde composites, the ways of their hardening and the methods for producing polymer-clay nanocomposites are given in the paper.

**KEYWORDS:** nanocomposite, polymer-clay, montmorillonite, hardener, carbamide -formaldehyde resin, metal-complex, strength, modification.

## **I. INTRODUCTION**

At present, fundamental and applied research in the Republic of Uzbekistan is crucial for studying the technology of polymer materials and their effective components, studying the peculiarities of polymer composites structure and their application in various sectors of the national economy.

Polymer technology is on the way to creating composite materials. This system allows the optimal composition of the polymer or any additives to the polymer. Additionally, the additives expand the properties of the high molecular links.

One of the promising directions is the creation of urea-formaldehyde-based composite materials that are easy to use and are relatively cheaper and cheaper.

However, along with its advantages, carbamide-formaldehyde compounds and compositions do not allow for a wide range of applications in construction materials and designs, such as physical and technical properties, low thermal stability and low chemical resistance. In order to improve the properties of the carbamide-formaldehyde compositions, they can be achieved by adding metallic compacting and activating filler, as the activated fillers improve the chemical bonding of the binder components, while the metallic compositor slows down the uptake carbamide-formaldehyde. In addition, the carbamide-formaldehyde powder improves properties such as metal compound and activated fillers, composition strength, thermal stability, viscosity module, adhesion properties and increased fire resistance. However, the nature of inter-phase interaction in the polymer system and the selection of scientifically-based components of nanodispers fillers remain a poorly studied issue.

## **II. SIGNIFICANCE OF THE SYSTEM**

In gluing wood and wooden building materials, various glue and filler are added to the glue to improve the properties of the glue layer. The stabilizer increases the susceptibility of the environment and accelerates the polycondensation process. The filler can reduce the consumption of the fibers and improve the absorption of glue when finishing the surfaces of wooden sheets with finely finishing materials. Additionally, the adhesive compositions provide a uniform grinding of quactured and porous surfaces, while eliminating the elimination of the elimination layer by reducing the penetration of the glue [1].



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## III. LITERATURE SURVEY

The idea of creation of polymer composition was proposed by the scientists of the Russian Federation, and scientific works on development of composition and technology of polymer composite materials in the Republic of Uzbekistan I.M.Elshin, S.Javrid, I.K.Kasimov, U.X.Magdeev, V I.Malikhtarovich, V.V.Pattoev, I.V.Putlyaev, Yu.P.Potapov, N.A.Samigov, V.Selyaev, Yu.S.Sokolova, V.Solomatov, M.K Takhirov, V. Kharchevnikov, K. Choshshchiev and others.

Today, carbamide-formaldehyde oligomers, which are distinguished by their fluidity, technological and economical efficiency, are widely used in construction. This product is a urea and formaldehyde that is involved in the polycondensation reaction, its molecular weight is less than 700. The carbamide formaldehyde is made up of ethers -  $\text{CH}_2 - \text{O} - \text{CH}_2 -$ ) and methylene ( $-\text{CH}_2 -$ ), the free methylol group -  $\text{CH}_2\text{OH}$ ). The presence of methylol free end group ( $-\text{CH}_2\text{OH}$ ) in the smolder affects the viscosity, the stability of the water mixing time and the velocity of the fastening [6].

Lack of sufficient data on the polycondensation mechanism of the carbamide-formaldehyde oligomer has led to the underdevelopment of a large number of products of the same nature. To obtain the carbamide-formaldehyde composition, it is recommended to use carbamide-formaldehyde oligomers with low concentrations of free formaldehyde, high concentrations and processing of KF-J, KF-MT, KF-BJ and KF-B carbamide-formaldehyde composition. [5, 11].

The results of the research showed that, in the same polycondensation conditions of carbamide-formaldehyde, the more free formaldehyde in the structure, the higher the survival rate. Working with this type of work will deteriorate the health conditions. The concentration of the sulphide increases from 50% to 70%, and the release of formaldehyde at the injection time decreases by 2.3 times. The stamp indicates that the free formaldehyde in the content does not exceed 1%. At room temperature, the shelf life is 130 to 150 days [7, 9].

Depending on the formaldehyde pH environment, the urea involved in the polycondensation reaction forms different products in the interaction between the components and the temperature reaction. The urea involved in the condensation reaction in a strong sour environment (pH - 3) flows with the formation of mono- and dimethylenemochevines, depending on the initial interconnection of the formaldehyde components. In a strong enzyme environment, monomethylol-mochevins are formed. However, this process does not end, and this reaction has a repetitive character.

In polystyrene, neutral or unconformably, urea forms soluble polymers in formaldehyde polycondensation. During the condensation of carbamide-formaldehyde oligomers, the methyl group forms, resulting in the growth of molecules. However, this process is very complex because several parallel reactions in the system (the condensation and hydrolysis condensation and hydrolysis differentiation process in various mechanisms) involves the constant reorganization of functional groups and connections [3].

As a result of research, it is possible to achieve the properties of carbamide-formaldehyde compositions by adding metal-coated and activated layers of silicate fillers, as the activated fillers improve the chemical bonding of the connector components, while the metallic condenser does not occur in the process of thawing of urea-formaldehyde. Addition of layered silicate fillers, which are also activated as a filler in the polymer, will enable the formation of new polymer nanocomposites.

Various researchers have pointed out the positive effect of the finisher on the glossy composition's technological properties [4, 8].

Polymer nanocomposites are composite materials whose matrix may be different types of polymers such as thermoplasts, such as elastomers, and plastics as filler particles in the polymer that penetrates the nanorazer range. The nanocomposites are divided into three main types, depending on the shape of the filler and the shape of the particles. [2]. When all the particles are nanorazeric, we work with isothermal nanoservers. For example, spherical silicate

particles obtained by "in situ zol-gel" can be obtained [12]. If particles form two nanorazered modified structures in two directions, they are called nanotubes or "mustaches".

When the third type of particles is only at the nanorazer level, the thickness of the attachment is in layers of several nanometers. The composites involved in this type of complement are called layered polymer nanocomposites.

There are many natural and synthetic materials in nature that can be found in nanoelastic fillers:  $M_6Al_2(OH)_{16}CO_3 \times nH_2O$  (where M = Mg, Zn and others) with the general chemical formula of graphite, molybdenum and lead sulphide compounds, layers of secondary hydroxides various layers of nature (layered silicates) - montmorillonite, saponite, kaolinite, vermiculite, hectorite and others [2].

Fibrous silicates are very common fillers: firstly, the nanoscale particles they have are the same and bodied form, providing high mechanical properties of the composites obtained therein, and the latter is easily found.

Polymers filled with particles of layered silicates provide rigidity, rigidity, thermal and thermoelastic stability of the material, gas shortage, as well as reduce the cost of finished goods.

Nano-composite materials are also of interest to their perinextic properties. The silicate layers do not pass liquid and gas molecules, and the diffusion coefficient of different liquids and gases in soil-polymer composites is reduced several times more than the diffusion coefficient of the given polymer. The thermal expansion coefficient is significantly reduced when a small (2-3%) soil is added to the polymer matrix, where the rigid layers of the silicate are not deformed and resist polymers bound to the heat expansion.

Soil nanocomposites have a very high decomposition temperature than clean polymers, with high thermal stability [2].

#### IV. METHODOLOGY

The glue used for glazed wood and wooden construction materials is added as a variety of additives and fillers. The strainer is added to increase the sour environment and speed up the polycondensation process. Fillers are mainly used to reduce the consumption of the clay and to ensure good adhesion to the surfaces of the clay with wood-stacking sheets. Additionally, the addition of glue compositions helps to completely cover well-treated and porous surfaces that lead to uneven clay, reducing the internal stress and intake of clay.

KF-J carbamidoformaldehyde powder (GOST 14231-78) - white liquid, density at 20 ° C - 1.3 g / cm<sup>3</sup>; ph-7-8.5; viscosity VZ-I at 40-60 s; concentration - 67 + 2%, free formaldehyde content - not more than 1%. The physical and chemical properties of KF-J are given in Table 1.

Table 1. Physical and chemical properties of KF-J.

No	Indicator name	Function and unit
	Appearance	The same solid suspension, white with a yellowish color, without any further addition
	Mass fraction of dry residue	67 ± 2 68 ± 1 (l)
	The percentage of free formaldehyde mass in the visual method (%), potentiometric titration (%), no more than	1,0
	60 milk. after viscosity of the viscosity VZ-1 (conical tube 5,4 mm) with conditional viscosity at a temperature of 20 ± 0,5 <sup>0</sup> S, no more than	15 – 40 (f) 40 – 60 (m) 25 – 30 (l) 120 (f) 180 (m) 90 (l)
	Concentration of hydrogen ion, pH	7,0 – 8,5



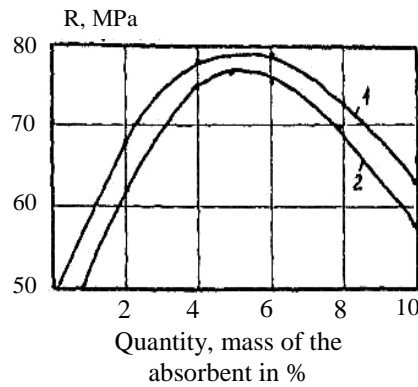


Figure1: Dependence on Sustainability of MKO-5  
1- in normal environments;  
2- in the heat treated environments.

The carbamide-formaldehyde polymer is reinforced by combining 4-5% of the MKO-5 stabilizing polymer mass, and can achieve high stability even under normal conditions. During the heat treatment of the polycondensation process of MKO-5 carbamide composition a strong catalysis occurs. In this case, the samples achieve a 90% strength. Then, when stored in normal conditions, the strength of the composition reaches 75-80 MPa. The MKO-5 is similar to that of the strong oxidizer of urea-formaldehyde oligomer by catalytic activity despite the almost neutral environment.

It should be noted that the polyalkylenamine in the carbamide campus agglomerates the polymerized building environment and increases the chemical resistance and durability of the composition to the aggressive environment.

This is evidenced by the change in the results of research on the strength and completeness of polyalkylenamine, chlorine galloid, bromine and iodine-based metallic-bearing carbamide-formaldehyde polymer coupling.

Table 1. Complete carbamide-formaldehyde polymer coupling with metallic compositor

Stabilizer	Full concentration, in%, over time, over time.			
	3	30	90	360
MKO-5	86,0	93,2	95,4	98,2

Table2. Strength of Urea-Formaldehyde Polymer Linking Metallic Complex

Stabilizer	Change in time (day) durability (MPa)					
	1	2	7	15	30	90
MKO-5	<u>10</u> 52	<u>32</u> 60	<u>51</u> 65	<u>72</u> 70	<u>78</u> 74	<u>80</u> 78

Natural clay Na + montmorillonite with a cation exchange capacity of 95 mg eq / 100 g with an average diameter of silicate plates of ~ 77 nm and Modified montmorillonite (MMT) were used as a filler.

In the ideal case, the chemical formula of MMT looks like  $m\{Mg_3[Si_4O_{10}][OH]_2\} \cdot p\{(Al^{3+}, Fe^{3+})_2[Si_4O_{10}][OH]_2\} \cdot nH_2O$ , where the ratio m:p is usually 0.8-0.9.

A special feature of the minerals of the montmorillonite group (montmorillonite  $[Al_2Si_4O_{10}(OH)_2 \cdot nH_2O]$ , beidellite  $[Al_2Si_3O_9(OH)_3 \cdot nH_2O]$ , nontronite  $[Fe_2Si_4O_{10}(OH)_3 \cdot nH_2O]$  etc.) is a high shunt, a high shunt, a subunit of the  $[Fe_2Si_4O_{10}(OH)_3 \cdot nH_2O]$ , etc., is a high shunt, a subunit of the  $[Fe_2Si_4O_{10}(OH)_3 \cdot nH_2O]$  and others. coherence, high degree of dispersion (80%  $< 0.001$  mm, of which 40–45%  $< 0.25$   $\mu m$ ), cation exchange capacity (80–150 mmol-eq / 100g) and a huge specific surface area (600–800  $m^2/g$ ).

The introduction of Na-MMT in concentrations of 2 wt.% In a carbamide-formaldehyde resin in the process of in situ polymerization leads, according to X-ray diffraction analysis, to intercalation of SS. At the same time, the reflex of intercalated Na-MMT shifts to the region of smaller angles two theta ( $6^\circ$ ), relatively non-intercalated, air-dry Na-MMT, the maximum of which is  $7^\circ$  (Fig. 2).

It should be noted that, depending on the concentration of the injected filler (2 wt.%), The intensity of the reflex increases (Figure 3).

Introduction to the urea-formaldehyde resin of the same amount of modified MMT (Cloisite 30B), the modifier of which contains polar  $-CH_2CH_2OH$  groups for better compatibility with polar polymers and monomers, does not lead to a noticeable change in the position of the reflection on diffraction patterns. The characteristic Cloisite 30B reflex with a maximum at  $6^\circ$  remains stationary, and the reflex intensity increases proportionally with increasing concentration of the injected filler (Figure 5).

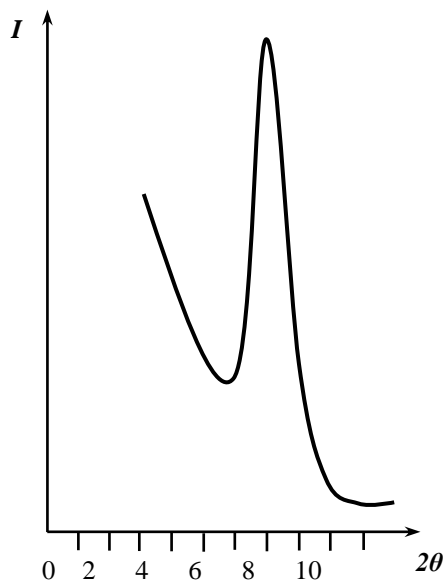


Figure 2: Radiograph of Na + -montmorillonite

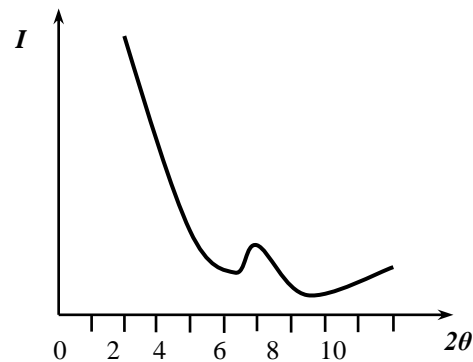


Figure 3: Radiograph of the composite with 2% of the mass. Na + montmorillonite

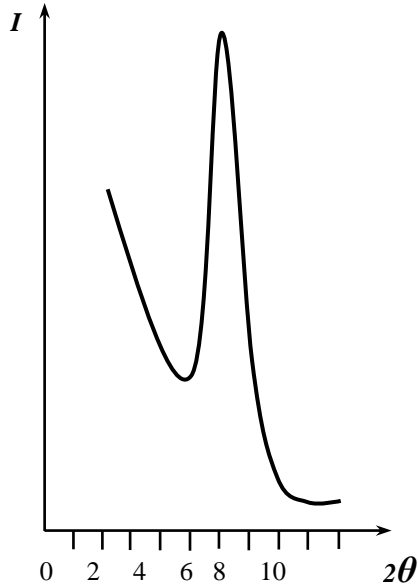


Figure 4: Radiograph of the modified montmorillonite

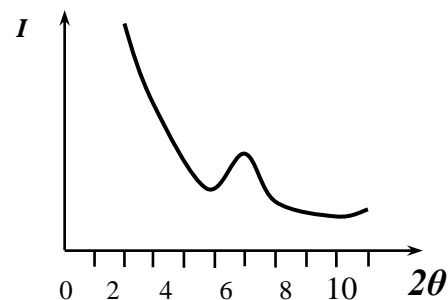


Figure 5: Radiograph of the composite with 2% of the mass. modified montmorillonite

Perhaps such a difference between the two types of MMT is associated with insufficient shear fields required for the intercalation of the polymer in the MCP filler and (or) with insufficient compatibility of the modified montmorillonite.

## VI. CONCLUSION AND FUTURE WORK

As a result of the investigations, the heat-treated polypropylene blanket of the MKO-5 carrier-formaldehyde polymer binder increases and increases the durability of the polymer binder. The durability of this carbamide-formaldehyde binding agent in normal conditions for 12 days is 12, 10 MPa, 30 and 90 days 80, 78 and 84, 80 MPa. Heavy MKO-5 carbamide will be 46-52, 62-74 and 78-82 days in the heat treatment of commercially 1, 30, 90 days.

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