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# INVESTIGATION OF THE PARTICIPATION OF SILICONE IN THE PROCESS OF SOPOLYMERIZATION

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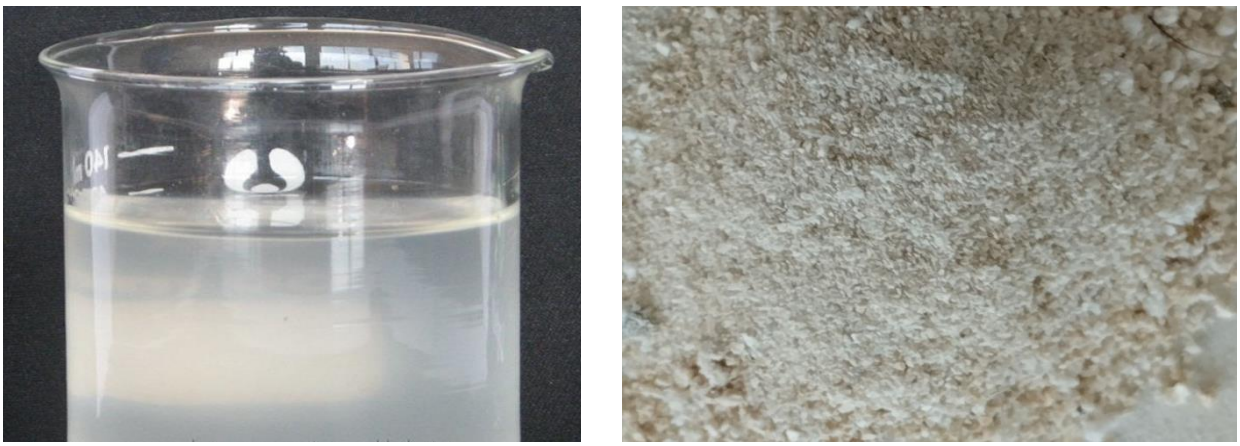
**Abstract**
This article is based on the sol -gel method hybrid organic-inorganic composites synthesis and electronic appearance of colloidal silica, properties of composites based on nitrogen-retaining polycompounds given.

**Keywords**: sol -gel, vinylmorpholine, copolymer, component, monomer, colloidal silica.

Sol-gel synthesis is one of the methods of obtaining hybrid organic-inorganic composites. Production of hybrid composites by this method is one of the new and rapidly developing directions. Products of sol-gel synthesis are characterized by high thermostability and mechanical strength, are widely used in enrichment processes, natural and wastewater treatment, analytical practice. The use of such an approach makes it possible to include an almost unlimited range of functional, including thermodynamically incompatible, compounds in the composition of synthesized substances [1-3].

Composite materials were formed by mixing the matrix and the finished organic copolymer. In this method of synthesizing hybrid composites, the stage of polymerization of organic monomer is abandoned and a high degree of homogeneity of the material is achieved [4-7] .

The obtained product has a low molecular mass and an amorphous structure with a globular particle size of 37-74 nm (Fig. 1. A – colloidal silica, B – synthesized ionite) and a specific surface area equal to 175 m 2 / g ·



**A** **B**

**Figure 1. A- electronic appearance of colloidal silica. B -synthesized ionite**

The resulting composite materials are solid powdery substances, insoluble in water, inorganic acid solutions and organic solvents, thermally stable.

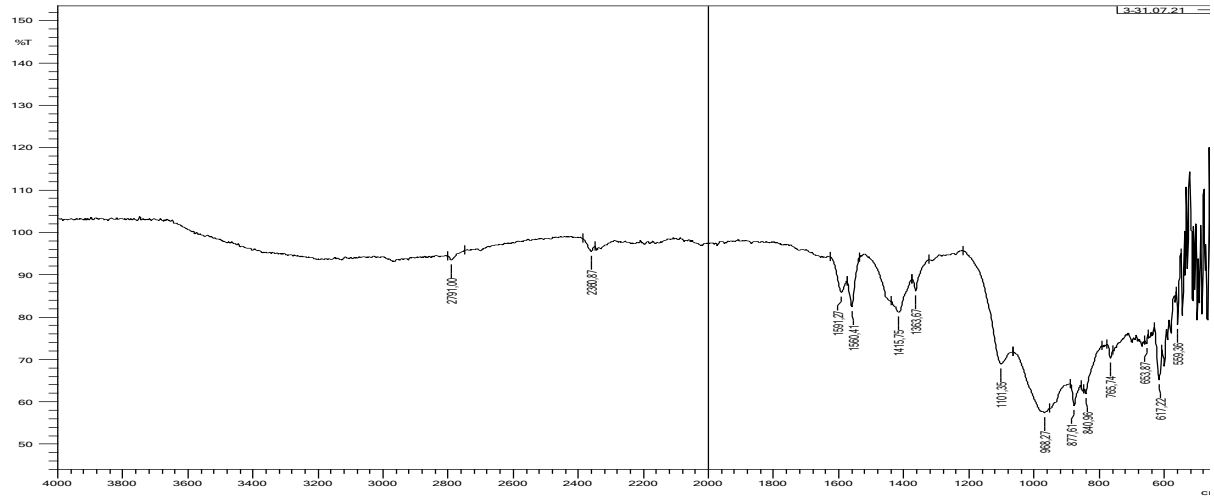
The high thermal stability of the synthesized composites is explained by the presence of silicon dioxide with a three-dimensional structure in their composition.

The formation of hybrid composites based on organic copolymers and matrix - silica gel by the sol-gel method is the result of the formation of semiconducting polymer networks, which are not chemically connected, but are linear and three-dimensional, which cannot be separated from each other due to the mechanical interlocking of their chains. consists of polymers of size. The formation of semiconducting polymer nets serves as a basis for obtaining new types of polymer materials, the properties of which differ sharply from the properties of the original components. the study of dynamic mechanical properties makes it possible to draw conclusions about temperature changes and compatibility of components in the tested systems [8-11].

**Table 1 Characteristics of composites based on nitrogen-retaining polycompounds**

| Composite | amount, % wt. | | $SiO_2$ _ quantity, % wt. | Yield, % | $T_{par.}$, ° C | $T_{bottle.}$, ° C |
|---|---|---|---|---|---|---|
| | N | Si | | | | |
| Vinylmorpholine-AK-KK | 6.4 | 7 | 15 | 60 | 258 | 56 |
| | 5.9 | 9.8 | 21 | 56 | 276 | 61 |
| | 4.2 | 20.5 | 44 | 71 | 329 | 84 |
| Vinylmorpholine-MMA-KK | 5.8 | 4.6 | 10 | 67 | 200 | 71 |
| | 5.2 | 9.3 | 20 | 66 | 254 | 82 |
| | 4.4 | 14.9 | 32 | 57 | 279 | 102 |

The compatibility of the organic and siliceous parts in the composites can be seen in the following examples, that is, phase separation is not observed when boiling at high temperature for a long time and when exposed to concentrated mineral acids (chloride, sulfate). The structure of the composites was determined by the method of scanning electron microscopy, according to which they are globules of the correct shape with a size of 0.25-0.5 μm.




**2 . IR spectrum of VM-AK-KK composite**

In the IR spectra of copolymers, the absorption lines belonging to the vinyl group (960, 1680 cm $^{-1}$ ) do not exist after polymerization, but the vibration lines of the rings of pyridine, pyrimidine molecules (1600, 1580, 1490, 1020 cm $^{-1}$ ) remain. Vibration lines of S=O (1720-1750 cm $^{-1}$ ) are also observed, which prove the presence of A K , VA fragments in the copolymer. In the IR spectra of the composites, intense absorption lines in the region of 1100-1250 cm $^{-1}$ corresponding to the valence vibrations of the Si-O-Si bond are shown, which confirms the formation of a three-dimensional silicon framework that is fused in the process of gel formation. . At the same time, a characteristic shift of the absorption line of the nitrogen atom in pyridine from 1600 cm $^{-1}$ to the region of 1630 cm $^{-1}$ with a higher frequency is observed. Valence vibrations of C= O (1720-1750 cm $^{-1}$ ) remain in the composition of composites . This feature of the IR spectra allows us to draw the following conclusion, that is, the formation process of the composites consists of the coordination union of the nitrogen atom in pyridine with the free silanol groups of colloidal silica.

**Table 2 used and synthesized compounds**

| substance / Group | Morpholine | VM | MMA | Cremnisol | VM-A K -KK | Ionite |
|---|---|---|---|---|---|---|
| > NH | 3350-3310 cm $^{-1}$ | - | - | - | - | - |
| -C -O- C- | 1050-1250 cm $^{-1}$ | - | - | - | 1050-1250 cm $^{-1}$ | 1050-1250 cm $^{-1}$ |
| -CH $_2$ - | 2950-2960 cm $^{-1}$ | 2950-2960 cm $^{-1}$ | - | - | 2950-2960 cm $^{-1}$ | 2950-2960 cm $^{-1}$ |
| C = O | - | | 1680 | - | 1680 | 1680 |
| - COOCH $_3$ | - | | 1310-1250 | - | 1310-1250 | 1310-1250 |
| -CH=CH $_2$ | - | 2975 | 1660-1640 | - | - | - |
| -Si-O-Si- | | | - | 1100-1000 | - | 1100-1000 |
| - OH | | | | 3200-3300 | 3200-3300 | 3200-3300 |

Table 2 shows that the displacement or disappearance of the reaction centers of the initial substances in the synthesized compounds indicates the progress of the reaction.

However, this type of interaction cannot be considered as the main factor for stabilizing the structure of the composites, because cremnisol is characterized by a small number of silanol

groups. Such formation of composites (according to the mechanism of semiconducting polymer nets) opens the possibility of wide application of hybrid structures.

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