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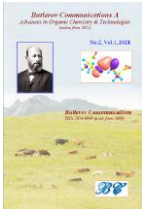

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Coordination binding of polyurethanes with iron complex compounds

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Abstract

The features of the interaction of coordination compounds of iron(III) with polyurethanes and the effect of metal complex bonding on the mechanical properties of modified PU and their specific volumetric electrical resistance have been investigated. A metal complex system based on monoethanolamine and ferric chloride was synthesized as a modifier. It was shown that their interaction is accompanied by a significant transformation of the IR spectrum of monoethanolamine. The occurrence of the complexation reaction accompanied by a significant change in the environment of iron ions was judged from the changes in the spectra in the electronic region of electromagnetic radiation. A qualitative change in the spectra was noted depending on the used molar ratio of monoethanolamine and ferric chloride. It is shown that, as a result of the interaction of the metal complex system with the urethane prepolymer, the coordination state of iron ions changes. According to the tests carried out, the metal complex modification leads to a non-monotonic change in the ultimate tensile strength and ultimate elongation at break of polyurethanes. Up to the content of 0.6 wt.% of the metal complex, the strength increases sharply and is accompanied by an increase in the elasticity of the polymer material. Then there is a drop and again an increase in the strength of the modified polyurethanes. Such a non-monotonic change in physical and mechanical parameters can be associated with the hierarchical nature of the construction of the macromolecular structure of metal-coordinated polyurethanes. An unusual increase in the elastic properties of polyurethanes, accompanied by an increase in strength, is due to the fact that additional intermolecular bonds formed due to metal complex binding are labile. That is, in the process of elongation, the coordination binding of the ester groups is sequentially destroyed and reappears on the unfolding flexible-chain ester components of polyurethanes. Coordination bonding leads to a decrease in the specific volumetric electrical resistance of

the obtained polyurethanes by three orders of magnitude. The results obtained in this study are of practical interest, since they are a way to increase the strength, elastic characteristics of polyurethanes, combined with the ability to significantly affect their electrical properties.

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