

## Synthesis and study of polyfunctional silicon-containing amines as adhesion promoters of epoxyamine compounds

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### Abstract

At present, in order to obtain high-tech hybrid products, high demands are placed on modern adhesives for creating durable joints between dissimilar materials. It is known that adhesion depends on the compatibility of the adhesives with the surfaces of the materials. For epoxy compositions, amine compounds are the main hardeners. In this regard, in the presented work, silicon-containing amines were synthesized based on polyfunctional aminoalkoxysiloxanes for epoxy compositions, the strength of attachment of which to various metal substrates was studied using these adhesion promoters. Aminoalkoxysiloxanes were prepared by reacting 3-aminopropyltriethoxysilane with monoethanolamine in nitrogen at atmospheric pressure in the presence of a binary antioxidant and catalytic amounts of an alkali metal alcoholate. To carry out the reaction in a homogeneous phase, the reaction mixture was heated to a temperature of 100-110 °C and distilled off to 90% of ethanol from the theoretically calculated amount. Further, the reaction was carried out at a reduced temperature of 10-20 millimeter of mercury pressure until the release of alcohol stops. At the same time, gravimetric control was carried out and the refractive index of the reaction mixture was measured. As a result, aminoalkoxysilanes were obtained in the form of light-yellow oily liquids. The structure of the obtained compounds was investigated by IR-spectroscopy on a Fourier spectrophotometer FSM-1202 and <sup>1</sup>H NMR-spectroscopy on a high-resolution BrukerWM-250 NMR-spectrometer. It was found that under the selected synthesis conditions, aminopropyl-tri-(2-aminoethoxy)silane is obtained with the highest yield of 97.6% at a molar ratio of 3-aminopropyltriethoxysilane (AGM-9) with monoethanolamine 1: 3. The obtained compounds were used in the composition of epoxy compounds in order to improve their physical and mechanical properties. The adhesion properties of epoxy compositions based on ED-22 epoxy resin and isophorone diamine were studied using synthesized polyfunctional aminoalkoxysiloxanes as adhesion promoters. It was found that the most effective adhesion promoter is aminopropyl-tri-(2-aminoethoxy) silane.

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- SYNTHESIS AND STUDY OF POLYFUNCTIONAL SILICON-CONTAINING AMINES AS ADHESION...* \_\_\_\_\_ 28-32  
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