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Study of the interaction of tin(II and IV) and titanium(IV) oxides with polyphenylsiloxane by mechanochemical activation

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Abstract

The interaction of polyphenylsiloxane (PPS) with tin(II and IV) and titanium(IV) oxides was studied under the conditions of mechanochemical activation in the planetary monomill "Pulverisette 6". Soluble polytinphenylsiloxanes (PSnPS) with a tin content of 3.2% (using tin(IV) oxide-PSnPS 2), up to 5% (using tin oxide(II)-PSnPS 1) and polititanophenylsiloxanes (PTiPS) with a titanium content of 12.0% were obtained . A large proportion of the soluble fraction and a higher percentage of tin entering the chain when using divalent tin oxide is explained by the fact that the initial tin(II) oxide was taken as crystalline hydrate $SnO \cdot 2.7H_2O$, which contributed to the homogenization of the medium. In addition, a smaller charge increased the polarizability of the ion and facilitated its entry into the chain. A higher percentage of the occurrence of a titanium atom in the polymer chain compared to tin is associated with a higher polarizability of the titanium atom due to its larger radius. It is shown that the ratio of Si/Sn and Si/Ti obtained in PSnPS and PTiPS differs from the given one (1:1). For PTiPS, it is 2.5 after 3 minutes of activation and does not change with 5 minutes of activation. The ratio of Si/Sn in PSnPS-1 and PSnPS-2 is 19.7 and 14.9, respectively. The obtained results are compared with the results of similar syntheses carried out in an oscillatory type activator. It has been shown that in a planetary ball mill with high energy density, along with the formation of polytinphenylsiloxanes, partial impregnation of PSnPS in tin oxide can occur. This explains the formation of a tin-insoluble product with a high tin content (insoluble fraction). The composition of the products obtained was studied by the methods of elemental, X-ray phase analyzes, gel permeation chromatography, IR and NMR spectroscopy. An increase in the structure ordering with the introduction of a titanium atom into a siloxane chain is shown.

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