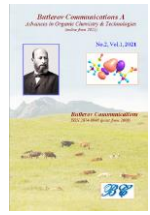
Butlerov Communications A
Advances in Organic Chemistry & Technologies
ISSN 2074-0948 (print)

2021. Vol.1, No.2, Id.20.
Journal Homepage: https://a-journal.butlerov.com/

BUTLEROV HERITAGE



Full Paper

Thematic section: Preparative Study.
Subsection: Chemistry of Organoelement Compounds.

The Reference Object Identifier – ROI-jbc-A/21-1-2-20
The Digital Object Identifier – DOI: 10.37952/ROI-jbc-A/21-1-2-20
Received 10 June 2021; Accepted 10 June 2021

Nanostructuring of polymethylphenylsiloxane resin with isopropyl ether of orthotitanic acid

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Keywords: titanium oxide, polymethylphenylsiloxane, isopropyl ether of orthotitanic acid, atomic force microscopy, nanoparticle.

Abstract

The paper deals with the interaction of an organosilicon polymer-polymethylphenylsiloxane with isopropyl ether of orthotitanic acid. Orthotitanic acid of isopropyl ether is a precursor of titanium dioxide nanoparticles. The nanostructure of the coating surface and the influence of the composition and nature of the components of the nanostructured material on its properties are studied. To study the nanostructure of the surface of the protective coating, the method of atomic force probe microscopy was used using the Integra Aura device manufactured by NT-MDT in Zelenograd, Russia. It is revealed that the process of structuring occurs in two directions. The first direction is the interaction of reactive hydroxyl groups of polymethylphenylsiloxane resin with alkoxy groups of isopropyl ether of orthotitanic acid. The second direction is the formation of titanium dioxide nanoparticles during the complete hydrolysis of unreacted ether. Using the Horiba LB-550 microanalyzer, it was found that nanoscale particles of titanium dioxide with an effective size of 30-55 nm are formed during complete hydrolysis. Mechanisms of nanostructuring of polysiloxane are proposed. The physical and mechanical characteristics of the modified polymer are established. As expected, in the process of nanostructuring an increase in the impact strength of the material was observed from 14 kg·cm to 21 kg·cm. Simultaneously with the increase in impact strength, an increase in the relative Shore hardness was also observed.

The conducted studies showed the possibility of nanostructuring polymethylphenylsiloxane resin with isopropyl ether of orthosilicic acid and allowed us to identify the processes occurring during the modification process. The influence of the modification on the increase in the physical and mechanical characteristics of the composition is established. The possibility of applying the results of the work in the form of using a modified resin as binding materials and protective coatings with improved characteristics is shown.

For citation: Vladimir Yu. Chukhlanov, Kirill V. Smirnov, Natalia V. Chukhlanova. Nanostructuring of polymethylphenylsiloxane resin with isopropyl ether of orthotitanic acid. *Butlerov Communications A.* **2021**. Vol.1. No.2. Id.20. DOI: 10.37952/ROI-jbc-A/21-1-2-20

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