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New approach to the formation of organo-inorganic borosyloxane polymer structures

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Abstract

Using sol-gel methods, new synthetic approaches to the preparation of boron-containing organic-inorganic hybrid polymers based on boron oxide (boric anhydride), which is a part of many inorganic materials, have been developed. Previously, such methods were used to obtain amorphous silicate glasses and their use allows introducing various inorganic and organic modifiers into the matrix of silicon dioxide and other compounds at temperatures up to 120 °C.

Within the framework of this work: a) the conditions for obtaining saturated solutions of boron oxide in organic solvents were found and it was found that boric anhydride is most completely dissolved in triethyl orthoformiate (approximately 25%) at 110-110 °C retaining its structure; b) by the condensation of boric acid with 1,3-dichlorotetraphenyl disiloxane, functional borcyclosiloxanes were synthesized to further modify boron oxide. The reaction conditions, spectral and thermal characteristics of condensation products were investigated. It is shown the increasing in the synthesis time to 15-18 h, a bicyclic borsiloxane is formed; c) homophasic modification of boric anhydride with monofunctional cyclic borsiloxanes was carried out and it was shown that the formation of Si-O-B bonds at 110-120 °C occurs due to the use of anhydrous sol-gel process. Transparent films are obtained from modified boric anhydride solutions deposited on glass and stainless steel, followed by curing at a temperature of 160-280 °C, that are not subjected to hydrolysis under the action of air moisture and are stable in air up to 600 °C.

As a result of the work, the possibility of obtaining a borsiloxane type polymeric structures having an inorganic molecular skeleton modified with organosilicon compounds has been investigated.

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