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Synthesis of polycarbosilane using cobalt chloride(II) catalyst

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Abstract

In this work was studied the synthesis process of polycarbosilane that is a valuable forpolymer in the production of ceramic products, silicon carbide fibers, high-temperature protective coatings for high-speed aircraft, the initial product for the formation of microelectronic mechanical systems. Synthesis was carried out from polydimethylsilane under the influence of high temperatures from 350 to 400 degrees Celsius due to the rearrangement of Kobe. The possibility of polycarbosilane synthesis with a sufficiently high atmospheric pressure in the presence of a cobalt chloride(II) catalyst was shown. The synthesis was carried out in argon. The authors analyzed the obtained compound. The presence of carbosilane bonds in the polymer was identified by the method of infrared Fourier spectroscopy on the *Bruker Tensor 27* spectrometer. The received polymer has all the characteristic features of polycarbosilane. This is confirmed, particularly, by the presence in the spectrum of a strong absorption band of about 1035 cm^{-1}, due to fluctuations in the methyl group in the Si-CH_2-Si chain. To find the optimal synthesis conditions and obtain the maximum formation of polycarbosilane, the experiment was planned using the Box-Wilson plan. The effect of temperature, reaction time and catalyst content on the formation of polycarbosilane was studied. The optimal conditions for the synthesis are established. The highest formation of associated polycarbosilane was observed at 375 °C at a synthesis duration of 7.5 h. With an increase in temperature to 400 °C and duration of synthesis to 10 hours, a partial decrease in the polymer formation was observed. It is assumed that the intensity of the high temperature and a significant time of the process, begins the pyrolysis of polycarbosilane samples, accompanied by partial loss of mass.

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