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Modified silicon-carbide ceramics based on nanohafniumcarbosilanes

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Statement of the Problem: The regularities of the formation of ceramic phases of silicon carbide modified by hafnium compounds during the thermal transformation of nanohafniumcarbosilanes (I) under various conditions were investigated.

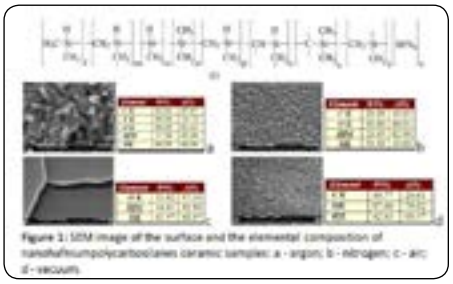
Methodology & Theoretical Orientation: Pyrolysis of nanohafniumcarbosilanes under argon, nitrogen or vacuum at 1500°C with exposure for 1 hour, according to XRD, results in the formation of silicon carbide as the basic phase (SiC 89-99%). Pyrolysis of nanohafniumcarbosilanes in air at 1500°C with exposure for 1 hour, according to XRD, results in the formation of quartz as the basic phase.

Findings: Low-crystalline ceramic samples have been obtained; the phases observed in them have a nanoscale character, which is manifested in strong broadening of the lines, with the exception of the quartz phase. Silicon carbide and hafnium phases, as well as quartz (except for the sample obtained in vacuum) are observed in the samples, the content of quartz is 0.6-0.7% for samples obtained in argon and nitrogen. The phase of silicon carbide is described by the structure of moissanite 3C. In samples where the hafnium content is above 10%, the phase of hafnium oxide IV is observed, and in the sample that is obtained in argon there are both cubic and monoclinic phases. On the diffraction pattern of the ceramics sample (Hf content >10%) 1500 in a nitrogen atmosphere, in addition to the aforementioned phases of silicon carbides and hafnium, a silicon nitride phase is present, which is described by the structure of the nierite (~0.5 %).

Conclusion & Significance: It is found that the thermochemical transformation of nanohafniumcarbosilanes at 1500 in different media (nitrogen, argon, air, vacuum) leads to the formation of ceramics, which differs not only in chemical composition but also in surface morphology.

Recent Publications

1. Shcherbakova G I, Blokhina MKh et al. (2014) Preceramic nanohafniumoligocarbosilanes. Inorganic Materials 50(4):423-430.
2. Shcherbakova G I, Storozhenko P A et al. (2014) Nanometallocarbosilanes: synthesis, physicochemical properties, structure. Journal of Chemistry and Chemical Engineering 8(3):232-242.
3. Storozhenko P A and Shcherbakova G I (2014) Advances in organoelement chemistry for the development of new materials. Mendeleev Communications 24:133-137.
4. Wen Q, Xu Y et al. (2014) Single-source-precursor synthesis of dense SiC/HfC_xN_{1-x}-based ultrahigh temperature ceramic nanocomposites. Nanoscale 6:13678-13689.
5. Vijay V V, Nair S G et al. (2016) Synthesis, ceramic conversion and microstructure analysis of zirconium modified polycarbosilane. Journal of Inorganic and Organometallic Polymer 26:302-311.



Biography

Mariya Kh Blokhina is a Researcher of the State Research Institute for Chemistry and Technology of Organoelement Compounds. Her scientific interests include synthesis, structure and reactivity of nanometallopolycarbosilanes, as well as obtaining components of ceramic composite materials on their basis.

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