

Obtaining and investigation of multifunctional alumina-based ceramic composite materials doped with carbon nanostructures

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The ceramic products based on aluminum oxide are widely used in many areas of science and technology, that is stipulated by their unique chemical and physical-mechanical properties. But as all ceramic material they are characterized by low toughness, that's why they belong to fragile materials and which significantly restricts the area of their use. Improvement of physical-mechanical characteristics of these materials is possible by reducing size of grains of pressing powdery composites to the nano-size and by inclusion by compounds with different structures (reinforcing components). Discovery of carbon nanostructures (graphene, nanotube, fullerenes) which at present have recording high mechanical, electrical and thermal characteristics among the known materials, has given new impetus to the researches for obtaining of ceramic materials with improved physical-mechanical properties for multifunctional purposes. Proposed work offered simplified technology for obtaining of aluminum oxide ceramics, reinforced with carbon nanostructures, during which chemical modification with doping carbon nanostructures was implemented in the process of synthesis of final powdery composite – Alumina. In charge doping carbon nanostructures were connected to matrix substance with C-O-AL bonds, that provided their homogeneous spatial distribution. In ceramic obtained as a result of consolidation of such powders carbon fragments were equally distributed in the entire matrix of aluminum oxide, that caused increase of bending strength and crack-resistance. The proposed way to prepare the charge simplified the technological process, decreased energy consumption, synthesis duration and therefore required less financial expenses.

In the implementation of this work, modern instrumental methods will be used: Electronic and optical microscopy, X-ray structural and granulometric analysis, X-ray and Raman spectroscopy. Determining of physical-mechanical characteristics will be carried out according to International Standards (ISO and ASTM).

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Biography

Tinatin Kuchukhidze has got an experience of many years in the field of obtaining aluminum metastable oxides and hydroxides. In 2018 she defended a thesis on „Obtaining of carbon nanostructures reinforced ceramic composite materials based on aluminum oxide “. She is an author of more than 35 scientific works. In terms of obtaining composite materials she's participated in several local and international projects. The most notable are two individual research on the following topics: “Lowtemperature phase transformation of meta-stable aluminium compounds in ultra-fine α - alumina and development of obtaining technologies of ceramic powdery composites with different purposes” and “Obtaining and Investigation of Multifunctional Alumina-Based Ceramic Composite Materials Doped with Carbon nanostructures”. She is a member of the European Society of Ceramics and the Georgian Association of Ceramics. She is currently working as a senior researcher at Ilia Vekua Sukhumi Institute of Physics and Technology.