Heat Resistant Unfired Phosphate Ceramics with Carbon Nanotubes and Boron Compounds for Electromagnetic and Ionizing Shielding Applications

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Many modern industrial applications ranging from electromagnetic (EM)interference shielding to nuclear energetics require the design and fabrication of new materials with controlled physical properties, including hardness, mechanical strength, high thermal stability, electrical conductivity, etc. Because of their advanced properties phosphate physical based composites could be very interesting for different practical uses, e.g. as a matrix for effective EM and/or ionizing radiation shields. Phosphates working temperatures



Fig.1. Comparison of experimentally measured dielectric spectra (dots) and its modeling (solid lines) for composites containing MWCNTs of various diameter at the constant concentration 1.5 wt. %

could reach 1600-1700 °C, whereas the curing can be done at room temperature. Some of the developed phosphate composites have been used as thermal insulation plates in Energiya-Buran spacecraft [1]. Filled with boron compounds, phosphate/boron composites were proved as effective materials for slow neutrons absorption and collimation [2]. Here we report the fabrication of phosphate ceramics filled with multi-walled carbon nanotubes (MWCNT) of different diameter by energy-efficient method. It has been observed that the percolation threshold shifts into the lower concentration range for MWCNT with smaller diameter together with increase of the absolute values of electrical conductivity.

References

- Ph. Krylova, et al, High-temperature glue composition, *Patent* 2066335. RU. Bulletin No 25, September 10 (1996)
- 2. P. P. Kuzhir, et al, Nanoscience and Nanotechnology Letters 4(11), 1104 (2012).