HEAT RESISTANT CARBON NANOTUBES BASED INORGANIC UNFIRED CERAMICS FOR NUCLEAR APPLICATION

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Many practical applications of modern nuclear science require the design and fabrication of new materials with controlled physical properties, including hardness, mechanical strength, high thermal stability, electrical conductivity, etc. Design and control of wide range of correlated material properties implies utilizing of composite materials, based on various types of host matrix and fillers. Because of their advances physical properties, first of all heat and fire resistance, phosphate based composites could be very interesting for different nuclear physics uses, e.g. as a matrix for fabrication of ionizing radiation shields. The composites based on phosphates filled with multi-walled carbon nanotubes (MWCNT) of different diameters were fabricated at low temperatures by energy-efficient method (see Fig.1a). It was observed experimentally and proved theoretically that the percolation concentration increases with nanotubes diameter (Fig.1b). Moreover, the absolute values of electrical conductivity have been observed to be higher for the case of using thinner MWCNTs. To conclude, it is possible to fabricate thermally stable material for nuclear physics applications, e.g. phosphate filled with boron compounds for producing effective neutron shields or for neutron collimation, allowing at the same time to organize nondestructive control due to addition of small amounts of third functional conductive filler, MWCNT.

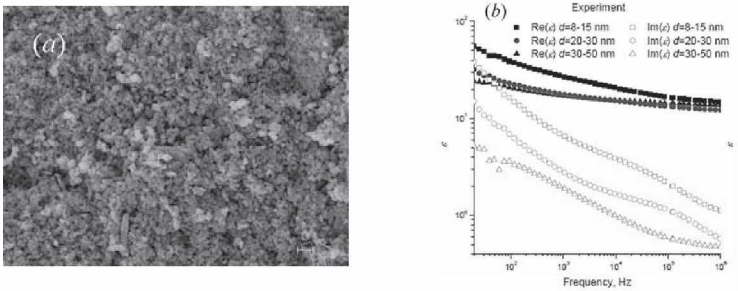

Fig. 1. (a) SEM image of phosphate filled with 1.5 wt.% of MWCNT; (b) Dielectric permitivity of 1 wt.% of MWCNT/phosphate composite vs frequency.