

Barium Titanate and Bismuth Oxide Nanocomposites

Barium titanate, BaTiO_3 , and bismuth oxide Bi_2O_3 are transparent materials with refractive indexes > 2.2 (20,21). They are attractive candidates for use in the design of novel materials for dielectric components used in filters, lenses, waveguides, etc. At higher filler loadings, they can be used as gamma radiation shields. A high proportion of heavy atoms allows them to absorb gamma radiation (22). This is in contrast to CGR shielding materials that require atoms with large nuclei. In order to produce transparent polymer composites either the refractive index of the polymer must match that of the filler, or, the nanofiller must not contain particles in the size range of the wavelength of light needed for the application. The refractive index of most polymers does not approach 2.2. We are probing the filler contents of nano BaTiO_3 and nano Bi_2O_3 in various polymers in an attempt to design transparent radiation shielding materials. Also of importance is the design of shielding materials that are lead-free. If we cannot shield effectively at nanofiller levels where transparency is maintained, we will use the shields in non-optical applications. We will design, synthesize and characterize a series of these composites. Mechanical and dielectric characterization will further probe the interaction of the nanofillers with specific polymer groups partaking in secondary relaxations. This will enhance our basic understanding of the unique influence of nanosize particles on relaxations that have not been observed in micron size filler systems. NASA Kennedy has funded an unsolicited proposal to provide funds for a graduate student and materials for this work.

References

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