BATIO3 AND GOLD CONFINED IN NANOPOROUS SILICA AND ALUMINA MATRICES

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Abstract

Using the sol-gel technique (multiple soaking and annealing), BaTiO3 was embedded into nanopores of Vycor silica glass (~6 nm pore diameter), artificial opal and nanoporous anodic alumina (pore diameter in the order of 100 nm). The BaTiO3 sol (concentration 0.23 M) was prepared from Ti-ethoxide, Ba-methoxyethoxide, acetylacetone as modifier and methoxyethanol as solvent.

For the characterization, X-ray diffraction, field emission scanning electron microscopy, and dielectric spectroscopy in a broad frequency range were used. The intrinsic size effect on the ferroelectric phase transition is rather difficult to reveal owing to the depolarizing field effects. Evidence of a diffuse ferroelectric phase transition was observed in the opal and anodic alumina – BaTiO3 composites, where the BaTiO3 shows crystallinity. No appreciable phonon confinement was observed except for soft polar phonon stiffening due to the depolarizing field. On the other hand, no crystalline BaTiO3 phase was formed in the nanoporous Vycor glass, but the amorphous phase comprised ferroelectrically distorted TiO6 octahedra.

Preliminary experiments with the gold filling of Vycor glass using UV-light activated reduction of HAuCl4 solution in methanol and its dielectric characterization will be reported as well.

Keywords: BaTiO3, gold, nanoporous matrix

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