

Editorial

Nanoceramics: Synthesis, Characterization, and Applications

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Over the past decade, nanoceramics have received significant attention as candidate materials due to their capability to demonstrate improved and unique properties in comparison with conventional bulk ceramic materials. Nanoceramics exhibit unique processing, mechanical, and surface characteristics such as superplasticity, machinability, strength, toughness, and bioactivity due to the fine grain size, abundant grain boundaries, and controllable crystallinity.

This issue compiles five exciting manuscripts, which address recent trends and development in nanoceramics.

The optical properties of nanoceramics are addressed in three manuscripts. Optical nonlinear performance of silicon nanoparticles at different doping concentrations has been investigated by L. Chen et al. Their results show silicon nanoparticles generated by femtosecond laser ablation exhibit better saturable absorption performance at higher doping concentrations. Their results reveal the possibility to tune the optical nonlinearity of silicon nanoparticles by changing the doping concentration.

In recent times, there are great interests in luminescent materials for efficient frequency conversion from infrared to visible radiation; oxyfluoride glass ceramics are ambivalent materials which can exhibit optical properties of fluoride single-crystals when they are doped with rare-earth ions. M. H. Imanieh et al.'s manuscript focuses on improvement of Er^{3+} emissions in two series of oxyfluoride glass ceramics ($\text{SiO}_2/\text{Al}_2\text{O}_3$ and $\text{SiO}_2/\text{Al}_2\text{O}$) containing CaF_2 nanocrystals doped with a fixed amount of Er^{3+} and Yb^{3+} through the

heat treatment at different temperatures. They showed in their study that increasing the temperature of the heat treatment leads to a rise in the red and green emissions in the upconversion luminescence of the treated samples. Also, increasing the heat treatment temperature leads to the incorporation of Er^{3+} ions into CaF_2 crystals and can increase the Yb^{3+} concentration. Increased Yb^{3+} concentration improves the energy transfer and back transfer process between Er^{3+} and Yb^{3+} ions and as a result upconversion intensity can be increased.

Polymers have attracted a lot of attention as excellent host materials for encapsulation of metal nanoparticles like silver, gold, copper, and so forth. Many reports in the literature show attempts for synthesis of metal-polymer nanocomposites based on polymers, with the possibility of variation in their optical, mechanical, and electrical properties for the application in photovoltaic and biomedical devices fabrication. M. Ghanipour et al. investigated the effect of silver nanoparticles doped in PVA on the structural and optical properties of composite films. Their results show that by embedding silver nanoparticles inside the polymer, a number of Bragg's planes in the structure of polymer and its crystallinity are increased noticeably. Ag-O bonds are formed in the films and the bandgap energy, refractive index, and dielectric constant of samples are decreased by increasing the concentrations of silver nanoparticles.

Two of the manuscripts deal with fabrication methods for high performance nanoceramics and nanomaterials; Q. Liu et

al. reported the new method for fabrication of highly ordered Ti-Nb-Zr-O nanotube arrays through pulse anodic oxidation of Ti-Nb-Zr alloy in monosodium phosphate containing 0.5 wt% HF electrolytes. The effect of anodization parameters and Zr content on the microstructure and composition of Ti-Nb-Zr-O nanotubes have been studied using experimental analysis and it has been found that length of the Ti-Nb-Zr-O nanotubes increased with increase of Zr contents.

Y. Qiang et al. investigated the materials and chemical properties of BCFN dense ceramic membrane with submicron-CYDC porous layer by the partial oxidation of coke oven gas (COG) in hydrogen production. The results of their study show that this structure exhibits higher stability and no chemical reaction at high temperature environment. Also, the influences of YDC modification on the surface kinetics and oxygen permeation rates of BCFN membranes have been analyzed.

By compiling these papers, we hope to enrich our readers and researchers with respect to synthesis, characterization, and applications of nanoceramics.

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