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PEROVSKITE PARTICLES AND NANOSTRUCTURES BY SELF-ASSEMBLY

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Controlled self-organization of nanocrystals in aqueous media can be a powerful tool to obtain (nano)particles and more complex architectures with well-defined morphology and new modified properties. Aggregation of nanocrystals produces polycrystalline assemblies which can be ordered or disordered. The oriented aggregation of nano buildings blocks overcomes the classic concept of crystal growth, which is typically thought to accur via atom-by-atom or monomer-to-monomer addition of existing nucleous. Secondary nucleation on the surface of existing crystals represents a further mechanism for the growth of particles with some level of internal organization. We will show some examples of self-assembly processes in the synthesis of $BaTiO_3$ and $SrTiO_3$ mesocrystals from aqueous suspensions of amorphous titanium hydroxide. The assembly process can be controlled by varying the temperature and the concentration of the solution as well as by introducing suitable organic molecules. Core-shell structures can be obtained when the assembly process occurs at the surface of template particles suspended in the solution. The coating of $BaTiO_3$ spherical particles with $SrTiO_3$ and $BaZrO_3$ nanocrystals and the possible application of this process in the field of dielectric materials will be discussed.

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STRUCTURAL PROPERTIES OF GADOLINIUM DOPED EUROPIUM SYNTHESIZED THROUGH AEROSOL

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High purity gadolinium oxide doped europium oxide powders (Gd_2O_3:Eu_2O_3) have been prepared using spray pyrolisis technique yielding submicrometer particles of spherical morphology. Comparative microstructural analysis of two different compositions (Gd:Eu = 0.09:0.01 and Gd:Eu = 0.08:0.02) was studied. The crystallization and nanostructure development of Gd_2O_3:Eu_2O_3 materials during thermal treatment were analyzed using XRD, DTA, SEM-EDS, TEM-HRTEM and EFTEM (EELS-ESI). The as-prepared particles are hollow agglomerates and consist of primary nanoparticles with a quite perfect spherical shape. After post-annealing, both the size of nanoparticle clusters as well as the crystallite size are proportionally increased with the thermal treatment temperature producing a better arrangement in the crystalline phase. The existence of three different nanocrystalline phases has been identified. In as-prepared sample, the main phase is a cubic phase (BCC unit cell) with the space group Ia3, and the unit cell paramenter a≈10.8 Å; the secondary cubic phase with FCC unit cell has a reticular parameter of 5.6 Å, with space group Fm-3m. After the thermal treatment only the cubic I3a phases has been observed, but at temperatures higher than 1100ºC, a monoclinic phase is identified. EELS-ESI allow differentiating the local chemical composition distribution of the Eu and Gd in the nanoparticles.