Solid-state synthesis of pure and doped lanthanide oxide nanomaterials by using polymer templates. Study of their luminescent properties

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We herein reports the solid-state synthesis of pure and doped lanthanide oxides by using polymeric materials (chitosan and polystyrene-co-poly(4-vinylpyridine), PS-co-P4VP) as a solid template. Lanthanide nanomaterials are prepared in two-step methodology combining both solution and solid procedures. The first involves the synthesis of macromolecular complexes Chitosan·[M(NO3)3//M?(NO3)3] and PS-co-P4VP·[M(NO3)3//M?(NO3)3] (M = La, Pr; M? = Eu); and the second consists in the pyrolysis at 800 °C of the as-prepared solid macromolecular complexes. The pyrolytic products were characterized by X-ray diffraction, SEM-EDS, TEM, and HR-TEM. Whereas similar particle size distribution in average (ca. 25 nm) was observed with both polymer templates, a higher degree of crystallinity was obtained by using PS-co-P4VP. Importantly, the emission luminescent intensity of the doped pyrolytic oxides, La2O3//Eu2O3 and PrO1,83//Eu2O3, is not quenched despite the presence of dopant. Thus, the as-prepared doped oxides exhibit an enhanced Eu3+ emission originated from the 5D0 ? 7Fn (n = 1, 2, 3, 4) transitions, which is more intense for the PS-co-P4VP template. This synthetic methodology base on the pyrolysis of polymeric complexes can be considered as a general and straightforward methodology leading to pure and Eu3+-doped nanostructured lanthanide oxide.

Chitosan

Europium-doped

Lanthanide oxide

Polymer-templated

Chitin

Chitosan

Doping (additives)

Europium

Luminescence

Macromolecules

Nanostructured materials

Particle size

Particle size analysis

Pyrolysis

Rare earth elements

Synthesis (chemical)

X ray diffraction

Degree of crystallinity

Europium-doped

Lanthanide oxide

Luminescent intensity

Macromolecular complexes

Poly(4-vinyl pyridine)

Synthetic methodology

Templated

Polymers