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Synthesis of Yttria-Based Crystalline and Lamellar Nanostructures and their Formation Mechanism

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Abtract

A nonaqueous synthetic route for the preparation of a regular crystalline yttria mesostructure is presented. The reaction between yttrium alkoxides and benzyl alcohol results in the formation of a highly ordered lamellar nanocomposite consisting of yttria layers with a confined thickness of about 0.6 nm, separated from each other by organic layers of intercalated benzoate molecules. Doping with europium leads to strong red luminescence. The nanostructure formation proceeds via two reactions. A C—C bond formation occurs between benzyl alcohol and the isopropanolate ligand. At the same time, yttrium oxide catalyzes two low-temperature hydride-transfer reactions to form benzoic acid and toluene from benzyl alcohol via benzaldehyde, thus limiting the growth of the thickness of the lamellae.