Self-Assembled Nanotubular Layered Double Hydroxides with Tunable Photoluminescence

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Self-assembled luminescent LDH nanotubes (Ø 20 nm) combine the potential of RE^{3+} containing LDH with a high surface area and easily accessible mesopore (175 m^2/g; 0.75 cm^3/g) suitable for hosting large sensitizing dyes and other interesting photonic species such as luminescent nanodots.[1] While standard Layered Double Hydroxides (LDH) represent a unique family of layered inorganic anion exchangers (with composition $[M^{2+}_{1-x}M^{3+}_x(OH)_2]^{x+}A^{y-}_{x/y}\bullet nH_2O$; A: anion; M^{2+}/M^{3+} divalent/trivalent metal cation), they exhibit a limited specific surface area and no mesopore volume.[2] The relatively weak interlayer bonding however results in excellent expanding properties and high uptake of bulky organic and inorganic anions. Partial isomorphic substitution with RE^{3+} ions results in a luminescent layered where anionic sensitizing dyes directly adsorb to the positive charge located on the RE^{3+} ions.[3] As such they can serve as antenna molecules efficiently transferring additional photon energy to the RE and offering a route for improving the quantum yield. This explains the huge potential for applying RE^{3+} containing LDH as luminescent material.

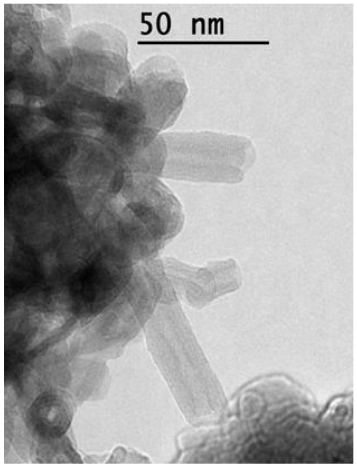

Fig. 1: Bright Field-TEM image of LDH nanotubes.

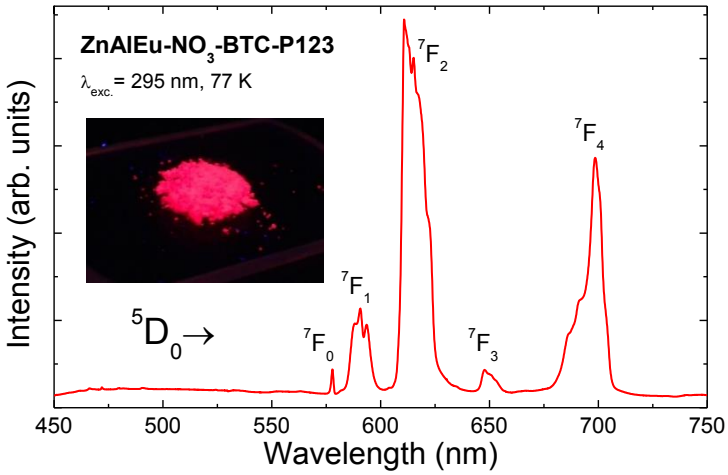

Fig. 2: Emission spectrum for the nanotubular mesoporous LDH recorded at 77 K and excited at 295 nm (BTC band). The inset shows the red emission.

Keywords: layered double hydroxide, nanotube, mesopore, rare earth, photoluminescence.

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