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Novel Synthetic Strategy towards BaFCl and BaFCl:Eu²⁺ Nanofibers with Photoluminescence Properties

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ABSTRACT: BaFCl and BaFCl:Eu²⁺ nanofibers have been successfully synthesized by one-step calcination of electrospinning-made PVP/Ba(CH₃COO)₂ and PVP/[Ba(CH₃COO)₂+Eu(NO₃)₃] composite nanofibers *via* a double crucible fluoro-chlorination method using ammonium hydrogen fluoride and ammonium chloride as fluorination and chlorination sources, respectively. The as-prepared samples have been characterized by X-ray diffractometer (XRD), scanning electron microscope (SEM), energy dispersive spectrometer (EDS), transmission electron microscope (TEM) and fluorescence spectrophotometer. XRD analysis reveals that BaFCl and BaFCl:Eu²⁺ nanofibers are pure tetragonal phase with space group of P4/nmm. SEM and TEM observation indicate that the as-prepared samples possess distinct fibrous morphology, and the diameters of PVP/Ba(CH₃COO)₂, PVP/[Ba(CH₃COO)₂+Eu(NO₃)₃] composite nanofibers, BaFCl, and BaFCl:Eu²⁺ nanofibers are 245±3, 266±3, 146±2, and 193±1 nm, respectively, which are analyzed by Gaussian statistics under the confidence level of 95 %. Photoluminescence (PL) analysis manifests that BaFCl:Eu²⁺ nanofibers exhibit the characteristic blue emission of predominant peak at 387 nm and weak emission at 365 nm respectively originating from 4f⁶5d→⁸S_{7/2} and ⁶P_{7/2}→⁸S_{7/2} energy levels transitions of Eu²⁺ under the excitation of 275-nm ultraviolet light, and the optimum molar concentration of Eu²⁺ is 8 %. The formation mechanism of BaFCl:Eu²⁺ nanofibers is also advanced. More importantly, this preparation technique is of universal significance, and can be applied to prepare other alkaline earth metallic fluoro-halide nanofibers.

Keywords: Barium fluochloride; Electrospinning; Nanofibers; Photoluminescence; Europium

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