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Novel Synthetic Strategy towards BaFCl and BaFCl:Eu^{2+} Nanofibers with Photoluminescence Properties

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ABSTRACT: BaFCl and BaFCl:Eu^{2+} nanofibers have been successfully synthesized by one-step calcination of electrospinning-made PVP/$Ba(CH_3COO)_2$ and PVP/[$Ba(CH_3COO)_2$+$Eu(NO_3)_3$] 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:Eu^{2+} 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/$Ba(CH_3COO)_2$, PVP/[$Ba(CH_3COO)_2$+$Eu(NO_3)_3$] composite nanofibers, BaFCl, and BaFCl:Eu^{2+} 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:Eu^{2+} nanofibers exhibit the characteristic blue emission of predominant peak at 387 nm and weak emission at 365 nm respectively originating from $4f^6 5d \rightarrow {}^8S_{7/2}$ and ${}^6P_{7/2} \rightarrow {}^8S_{7/2}$ energy levels transitions of Eu^{2+} under the excitation of 275-nm ultraviolet light, and the optimum molar concentration of Eu^{2+} is 8 %. The formation mechanism of BaFCl:Eu^{2+} 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