Oxide Nanosheets Structured Upconverting Nanofilms

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The lanthanide-doped upconversion nanomaterials have a nonlinear optical process involving sequential absorption of two or more photons leading to the emission of higher energy photons. These nanomaterials, because of their intriguing luminescent properties cover diverse applications such as solar cells [1], tissue engineering [2], safety inks [3] and display devices [4]. Single crystalline inorganic nanosheets, a class of 2D materials, are synthesized by chemical exfoliation of layered oxide materials. They are obtained from one-to-several nanometers thick depending on the composition of host layers of bulk materials. In this study, $K_2Ln_2Ti_3O_{10}$ (Ln: lanthanide), the Ruddlesden-Popper type perovskite, were doped with $La Yb^{3+}/Er^{3+}$, $Yb^{3+}/Tm^{3+}$, and $Tm^{3+}/Er^{3+}$ ion pairs and then exfoliated to produce upconversion crystallines. These nanosheets were deposited by the layer-by-layer method to fabricate upconverting nanofilms having ~50 nm thickness. These nanofilms show emission in different parts of the visible region by upconversion depending on the amount of doping with lanthanides and the annealing temperature of the layered materials. The characterization of the layered materials, nanosheets and nanofilms were performed using Atomic Force Microscopy, X-ray Diffraction Spectroscopy, Scanning Electron Microscopy-EDX and UV/VIS/NIR Spectroscopy techniques.

References


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