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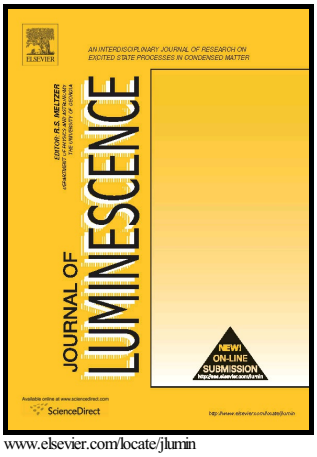

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Making yttrium orthovanadate a better color emission host: Case study of hollow-like nanocrystals

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Abstract

Novel Eu^{3+}-doped YVO_4 hollow-like nanocrystals were constructed via initiating homogeneous precipitation followed by a hydrothermal treatment. The phase structure, microstructure, band gap, and fluorescence performance of the hollow-like nanocrystals were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), Uv-Vis diffusion reflectance spectra (Uv-Vis), and photoluminescence spectroscopy (PL). The results showed that all prepared samples were well crystallized in tetragonal YVO_4 structure regardless of the doping concentration of Eu^{3+} ions from 0 to 15 mol%. TEM showed that all samples are composed of hollow-like nanocrystals with average diameters of about 20 nm, exhibiting a large-scale uniform morphology. A linear lattice expansion was observed due to evenly distributed of Eu^{3+} ions in the YVO_4 crystal lattice matrix. The bandgap energy E_g showed a red-shift below the doping level of 3 mol% of Eu^{3+} ions. More importantly, YVO_4 nanocrystals with hollow-like structure have a higher quenching Eu^{3+} ions concentration up to 10 mol%, compared to 5 mol% of the bulk YVO_4 host. Furthermore, the tunable color emission from blue to white to red can be achieved in hollow-like YVO_4 nanocrystals by controlling the doping concentration of Eu^{3+} ions. The nanocrystals with hollow-like structure reported in this work are very important, which may pave a new route to better the yttrium orthovandate host and further realize color tunable emission for laser, optoelectronics, and biomedical applications.

Graphical abstract