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Morphological, structural and photoluminescence properties of sol-gel synthesized strontium titanate (SrTiO₃:Pr:Al) nanophosphors

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Abstract content
   (Max 300 words)

Luminescent phosphors of Pr³⁺-doped MTiO₃ (Ca, Sr, Ba) has been reported being superior to those of the type Y₂O₃:Eu³⁺. However, as one of the tricolour, red LLP phosphors with efficient afterglow property are still deficient. Therefore, improving the luminescence property and afterglow performance of red LLP phosphors becomes an important task. In order to address these issues, Al³⁺ co-doped, Pr³⁺ -doped SrTiO₃, red nano phosphors were fabricated through sol-gel process, using citric acid and polyethylene glycol (PEG) as additives. The photoluminescence, crystallinity and particle morphology of persistent phosphors were investigated by using luminescence spectrometer, X-ray diffractometer (XRD) and scanning electron microscopy (TEM), respectively. The results showed that the acetic acid to polyethylene glycol mole ratio significantly affect the morphological, structural and photoluminescence properties of the nanostructures. The SEM micrograph depicts spherical and regular shaped structures with sizes in nano ranges confirmed by SEM and XRD measurements. The same XRD patterns display pure and well-crystalline SrTiO3 with cubic structure. Photoluminescence spectra revealed broad dominant emission from the 1D2⟶ 3H4 transition of Pr³⁺ at about 615 nm. The preparation parameters were found to affect significantly the luminescence intensity and afterglow property of the SrTiO₃:Pr;Al red phosphors. It is found that the addition of Al leads to the enhancement of red fluorescence and phosphorescence at 615nm originating from 1D2-3H4 transition of Pr³⁺, following the increase of the lifetime for the 1D2 state.

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