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Y₂O₃:Eu³⁺ nanophosphors: Synthesis by microwave-assisted heating method and characterization

Adrine Malek Khachatourian^{a,b}, Farhad G Fard^b, H Sarpoolaky^b, Carmen Vogt^a and M S Toprak^a

^aKTH – Royal Institute of Technology, Sweden

^bIran University of Science and Technology, Iran

Rare earth doped Y₂O₃ based nanophosphors, especially Y₂O₃:Eu³⁺ compounds have recently received an increased research interest due to their potential applications in display devices, temperature sensing devices, solid state lasers, as well as bio labels, bioimaging probes and medical diagnostics. Here, we report on the fabrication of monodispersed spherical Y₂O₃:Eu³⁺ nanophosphors using microwave-assisted heating method. This method is a green, energy efficient, high yield and highly reproducible. The effect of different reaction parameters on morphological characterization, as well as the correlation between Eu³⁺ doping and calcination temperature on the structural and luminescence properties of Y₂O₃:Eu³⁺ nanoparticles are investigated in detail. X-ray diffraction (XRD) analysis indicates that the as prepared particles have Y(OH)CO₃ composition, which converts to Y₂O₃:Eu³⁺ starting from 500 °C and become crystalline at higher temperatures. The transmission electron microscopy (TEM) micrographs show that the particles are spherical, monodispersed and non-agglomerated. High resolution TEM reveals polycrystalline nature of the calcined particles. Furthermore, increasing Eu³⁺ concentration from 0 mol % to 13 mol % the overall size of particles increases from 61 ± 8 nm to 86 ± 9 nm. Photoluminescence (PL) analysis of Y₂O₃:Eu³⁺ particles indicates a strong red emission peak at 613 nm corresponding to 5D₀-⁷F₂ forced electric dipole transition of Eu³⁺ ions under UV excitation. The emission peak increases proportionally with Eu³⁺ concentration and the calcination temperature with no luminescence quenching phenomenon observed even for Y₂O₃:13%Eu³⁺. The red emission characteristics, the morphological properties as spherical shape, monodispersity and nonagglomeration, combined with being heavy-metal free render these particles as promising bio-labels and bio imaging probes.

Biography

Adrine Malek Khachatourian has completed her BSc degree in Material Science and Engineering in 2008 and her MSc degree in Materials Engineering-Ceramic in 2010 from Iran University of Science and Technology (IUST). She spent two years on her PhD at (IUST) and now she is completing her PhD study at the Department of Materials & Nano Physics, KTH-Royal Institute of Technology, Stockholm, Sweden under the guidance of Prof. Muhammet S. Toprak. Her research interest focuses on synthesis and characterization of Rare-earth doped Yttrium oxide nanoparticles for fluorescent bioimaging via microwave method.

adrine@kth.se

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