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Luminescence of Mn²⁺ and Eu³⁺ doped zinc phosphate glass

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We report the photoluminescence (PL) of Mn²⁺ and Eu³⁺ doped zinc phosphate glass as melted. Raman and Energy-Dispersive X-ray Spectroscopy (EDS) were also used to get a better characterization. During the synthesis process the Mn²⁺ ions occupy tetrahedrally coordinated (IVMn²⁺) sites in the glass, but also partially precipitate on octahedral sites (VIMn²⁺) giving rise to the simultaneous green and red luminescence, due to the spin-forbidden 4T₁(G)→6A₁(S) and 4T_{1g}(G)→6A_{1g}(S) transitions in IVMn²⁺ and VIMn²⁺ respectively. Electron Paramagnetic Resonance (EPR) and lifetime measurements were also used to establish the presence of manganese ions in octahedral/tetrahedral coordination. The absorption transition 6A₁(S) →4E(D) of Mn²⁺ centered at 350 nm can produce red luminescence, while the transition 6A₁(S)→4A₁(G) of Mn²⁺ centered at 409 nm produces a green and red dual luminescence that is dependent on manganese concentration in the glass, being the green luminescence the dominant one. On the other hand the presence of Eu³⁺ produces also a red luminescence around 612nm due to the transition 5D₀ →7F₂. The manganese and europium ions form next pairs whose interaction gives rise to an increase in the europium red emission and an energy transfer process between both ions.

Biography

Since he was a student his passion has been for Solid State Physics, in particular for magnetic and optical properties of impurity ions in solid materials. He has worked on these themes in several laboratories around the world: Centro Brasileiro de Pesquisas, Rio de Janeiro and University of San Carlos, University of San Pablo both in Brazil. MIT, Boston, Mass. USA. Clarendon Laboratories, Oxford, England. Autonomus University of Madrid, Spain. Metropolitan University, México City and his home Universidad Nacional Autonoma de Mexico (UNAM). His work has been mainly on crystals such as LiNbO₃, BiGeO, BiSiO, HfO₂, Alkali Halides and recently on metaphosphate glasses impurified with a large variety of rare earth and transition metal ions. The results have been used to get knowledge about the structure of several crystal defects. The results have been published in more than 100 papers.

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