Synthesis and up-conversion luminescence properties of rare-earth ions co-doped phosphors

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Nowadays, the importance of phosphor materials increases because of their potentials in fundamental studies and technological applications. Phosphors are key factor in obtaining valuable up-conversion emission since the physical, chemical and spectroscopic properties depend strongly on the composition. Owing to their abundant energy levels for radiative transition and narrow emission spectral lines, trivalent rare earth ions such as Er^{3+}, Tm^{3+}, Nd^{3+} and Ho^{3+} are commonly used as the activator ions for up-conversion luminescence. A variety of previous studies on spectroscopic properties of rare earth ions doped in phosphors with different network formers and modifiers are available in literature. Especially, phosphors containing couple of rare earths ions will significantly be rich enough in demonstrating energy transfer phenomenon and infrared to visible up-conversion luminescence. In these optical device applications the short interaction length is compensated by the incorporation of high rare-earth (RE) concentrations. The rate of non-radiative energy-transfer interactions between the RE ions are strongly dependent on the distance between interacting ions. Therefore, a basic issue in the optimization of devices based on highly co-doping of rare earth ions and influencing of different metal oxides are the appropriate description of concentration-dependent energy-transfer inter atomic interactions. Some of the transition metal oxides mixed phosphors have attracted extensive investigation in recent years.