PHASE STABILITY AND LUMINESCENCE PROPERTIES OF $ZrO_2:Pr^{3+}$ AND $ZrO_2:Pr^{3+},Nb^{5+}$ NANOPHOSPHORS

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Transparent metal oxides, such as ZrO_2, constitute the basis for many functional optical materials. Optical properties (absorption, luminescence) of these materials are strongly affected by intrinsic defects, mainly anion vacancies, acting as chromophores, luminescence centres and charge carrier traps. It has been shown in previous works that high-temperature annealing of ZrO_2 in reducing or oxidizing ambient can distinctively modify its intrinsic photoluminescence (PL) and thermoluminescence (TL) [1]. Doping with certain heterovalently substituted impurities, such as rare earth (RE) ions, is also expected to result in significant alteration of vacancy concentration due to local charge compensation [2].

Hereby we synthesized various, Pr-doped, and Pr/ Nb-co-doped ZrO_2 nanopowders, annealed them at different temperatures (800-1200°C) and comparatively evaluated their structural and optical properties by using XRD, Raman spectroscopy and different photoluminescence methods to understand relaxation peculiarities of optically excitated of Pr^{3+}, the optical effects of vacancy formation and neutralization through phase transitions (Fig.1).

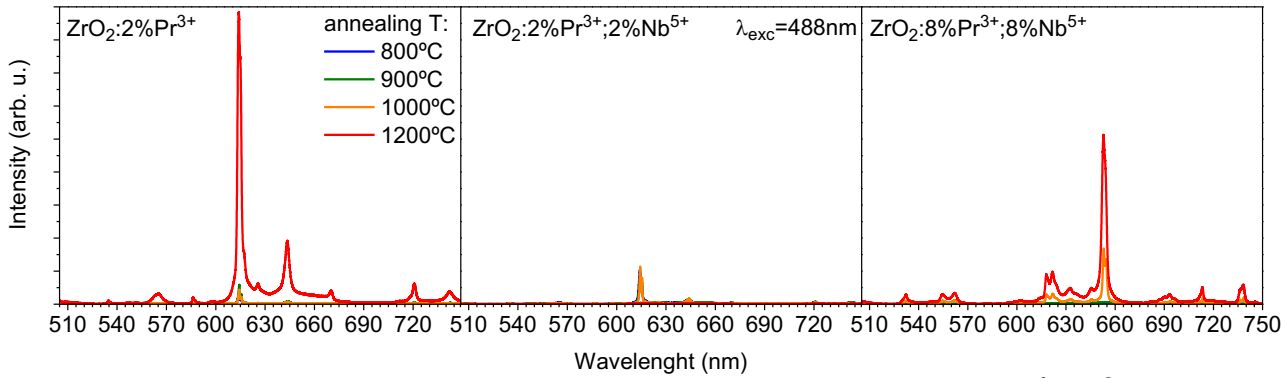

Fig.1 Luminescence spectra of ZrO_2 nanopowders doped with different amount of Pr^{3+}/Nb^{5+} and subjected to different annealing temperatures. Excitation at 488 nm.

References

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