

Effect of Heat Treatments on the Structural and Photoluminescence Properties of Hydroxyapatite Nanorods

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The improvement of traditional inorganic phosphors and the synthesis of new luminescent materials is of significant relevance for the development of more efficient, less-expensive, and environmental-friendly optical devices. In this sense, materials which possess enhanced defect-related photoluminescence (PL) properties, without lanthanide-based activator centers, could attempt to these necessities. These compounds have attracted interest for near ultraviolet (NUV) excitable light-emitting diodes and in biomedical field [1,2]. In this study, the effect of posterior heat treatments (200–800 °C) on the structural and defect-related PL properties of chemically precipitated hydroxyapatite [Ca₁₀(PO₄)₆(OH)₂]nanorods were evaluated. Intense, stable, and broad emission profiles were reached at 350 °C (bluish-white emission, 380 to 750 nm) and 400 °C (yellowish-white emission, 380 to 800 nm). The structural features were characterized by X-ray diffraction, Rietveld refinement, thermogravimetric analysis, and Fourier transform infrared spectroscopy, revealing significant order-disorder changes induced by heat treatments. The UV-Vis spectroscopy revealed band gap energies (5.58 to 5.78 eV) higher than the excitation energies (~3.54 eV at 350 nm), confirming the contribution of defect energy levels within the forbidden zone for PL emissions. These results confirm that by simple heat treatments, tunable and improved PL properties could be obtained in HA bioceramics.

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[2] C. Wang, *et al.* ACS Appl. Mater. Interfaces. 8 (2016) 11262-11271.