Synthesis of Bi$_{4}$Ge$_{3}$O$_{12}$ nanocrystalline phosphors by combustion synthesis with high pressure

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Bismuth Germanate (BGO) scintillators have been the focus of several studies due to their wide variety of applications in nuclear medicine, high energy physics and recently in bionanotechnology.

BGO phosphor powders were obtained by the pressure assisted combustion synthesis method (PACS) at various pressures. Subsequently, the obtained powders were subjected to a rapid In and rapid OUT (RIRO) process in heated air and different thermal treatments, resulting in bluish-white emitting nanophosphors. Morphology and microstructural properties were analyzed by SEM, X-ray diffraction (XRD) and transmission electron microscopy (TEM), respectively. XRD patterns after thermal treatments in the range of $T=800$-$950^\circ$C showed that the main phase correspond to Bi$_{4}$Ge$_{3}$O$_{12}$ and a small trace of Bi$_{12}$GeO$_{20}$ demonstrating that the conversion of crystalline phases of BGO is almost complete by the combustion synthesis method at these low-temperatures range. As analyzed by TEM, the samples presented symmetric spherical nanoparticles. Photoluminescence (PE) properties were also studied in detail. A blueish-white wide emission peak centered at $\lambda=495$ nm was detected when de BGO produced by PACS were excited with UV radiation of $\lambda_{ex}=285$ nm. It is expected that these novel materials would have applications, as multifunctional biomarkers, in the detection of cancer nanotumors.

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