Hydrothermal Synthesis of Rare-Earth Doped Nanoparticles for Energy Conversion and Storage

Reference	Presenter	Authors (Institution)	Abstract
01-079	Leonardo Henrique Comini Francisco	Francisco, L.H. (Instituto de Pesquisas Energéticas e Nucleares); Felinto, M.C. (Instituto de Pesquisas Energéticas e Nucleares); Brito, H.F. (Universidade de São Paulo);	In recent years, several classes of rare-earth doped luminescent nanoparticles have been drawing attention due to complex energy converting systems that can be structurally engineered to tune absorption and emission wavelengths, outlining novel materials and applications on photonics [1-2]. In this scenario, this work presents the development of rare-earth doped core-shell SrAl2O4:Eu2+/3+, Dy3+ nanoparticles prepared via hydrothermal synthesis and post-annealed on carbon monoxide reducing atmosphere, which exhibit appealing spectroscopic properties for solar energy conversion and storage. The prepared strontium aluminate phosphors were further amino-functionalized with 3-aminopropyltrimethoxysilane (APTMS) and ?-diketonate rare-earth complexes by microwave assisted synthesis [3], in order to enhance its absorption section and energy-transfer processes within the system. Prepared samples were analyzed by X-ray powder diffraction, which revealed a stable monoclinic phase of pure strontium aluminate accordingly to PDF34-379. Crystallite size was estimated by the Scherrer method, indicating dimensions of about 25 nm. Moreover, standard luminescence spectroscopy results of pure SrAl2O4:Eu2+/3+, Dy3+ showcased characteristic green Eu2+ emission assigned to the 4f65d1?4f7(8S7/2) interconfigurational transition under near ultraviolet excitation. It was also found that amino-functionalized samples display distinguished emission spectral profiles, as Eu2+ emission shifts on ?-diketonate coated samples, suggesting an effective interaction between the inorganic host-matrix, the silica network and the ?-diketonate complexes. Likewise, acquired excitation spectra monitored on Eu2+ emission revealed its characteristic broad band in the ultraviolet region, as well as non-reduced Eu3+ narrow absorption lines. In addition, ?-diketonate S0?Sn transitions were also observed on functionalized samples, unveiling an increasing absorption section under ultraviolet light. Finally, it is highlighted that prepared SrAl2O4:Eu2+/3+, Dy3+ persistent phosphors displayed intensifying characteristic green emission under UV light due to imposed surface modification processes by functionalization. Therefore, as its emission wavelength overlaps with a commonly used

dye (N719) in dye-sensitized solar cells, the materials assembled in this work aspire to enhance energy conversion efficiency and storage on such photovoltaic devices.
References: [1] E. Bonturim, et. al.; J. Alloys Compd., 732, 705-715 (2018). [2] Y. Li, et. al.; Chem Soc Rev., 45, 2090-2136 (2016). [3] A. Lourenço, et. al.; Optical Materials., 33, 1548-1552 (2011).
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