Down- and Up-conversion properties of Eu/Ho/Yb-doped CeO_2 nanoparticles prepared by spray pyrolysis

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Upconversion (UC) phosphor converting NIR to visible light has been great paid attention due to its many different application including bio imaging, solar cell, and security mark. In terms of improving the security, the anti-counterfeiting materials should be difficult to replicate as well as having multi-functionality. Thus, phosphors with DC and UC emission are attractive as security materials. In this work, Eu/Ho/Yb-doped CeO2 nanoparticles were synthesized by spray pyrolysis. To achieve the DC or UC emission that one can identify with the naked eye, the activator content was optimized and the crystallite size was controlled using some flux additives. Finally, the UC/DC nanoparticles were applied to prepare the emissive pearl pigments for high security materials.