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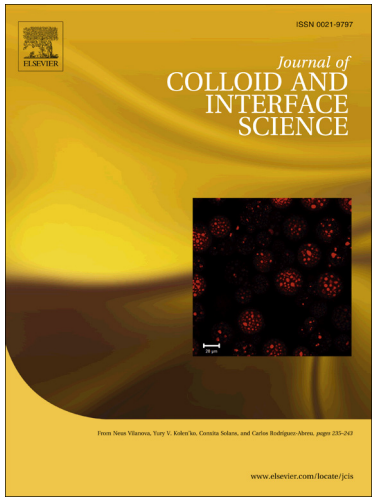

A Strategy to Achieve Efficient Dual-Mode Luminescence in Lanthanide-based Magnetic Hybrid Nanostructure and its Demonstration for the Detection of Latent Fingerprints

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PII: S0021-9797(16)31019-0
DOI: http://dx.doi.org/10.1016/j.jcis.2016.12.034
Reference: YJCIS 21868

To appear in: *Journal of Colloid and Interface Science*

Received Date: 1 September 2016
Revised Date: 8 December 2016
Accepted Date: 13 December 2016

Please cite this article as: P.K. Shahi, P. Singh, A.K. Singh, S.K. Singh, S.B. Rai, R. Prakash, A Strategy to Achieve Efficient Dual-Mode Luminescence in Lanthanide-based Magnetic Hybrid Nanostructure and its Demonstration for the Detection of Latent Fingerprints, *Journal of Colloid and Interface Science* (2016), doi: http://dx.doi.org/10.1016/j.jcis.2016.12.034

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A Strategy to Achieve Efficient Dual-Mode Luminescence in Lanthanide-based Magnetic Hybrid Nanostructure and its Demonstration for the Detection of Latent Fingerprints

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Abstract

We have synthesized a novel inorganic-organic hybrid nanostructure (IOHN) composed of fluoride nanophosphor ($NaGd_{0.78}Er_{0.02}Yb_{0.2}F_4$) and β-diketones complex ($Eu(DBM)_3Phen$). The Le Bail fitting of X-ray diffraction data suggests that the nanophoshor crystallizes in a hexagonal structure ($P6_3/m$ space group). The TEM studies reveal that the nanophosphor and the IOHN both have average particle size of 6-8 nm. The $Eu(DBM)_3Phen$ and $NaGd_{0.78}Er_{0.02}Yb_{0.2}F_4$ show characteristic down-shifting (DS) and up-conversion (UC) emission, under UV and NIR excitation, respectively. The IOHN comprises an excellent dual-mode optical features (DS and UC) of both the phases. Energy transfer from Er^{3+} (doped in inorganic phase) to Eu^{3+} (coordinated in organic phase) clearly demonstrates for a viable coupling between both the phases. IOHN material was found to be unique for the visualization of latent fingermarks. Because of ultrafine particle size the surface to volume ratio is relatively higher which improves the attachment of particles with the fingermarks. On the other hand, the strong paramagnetic property helps to remove excess material with magnetic wand easily. These properties provide an opportunity to probe even very weak fingermarks. Notwithstanding this, the dual-mode emission is useful for the visualization of latent fingermarks on multi-color surfaces as well.

Keywords: Lanthanide complexes, dual-mode luminescence, nanophosphor, latent fingerprints, energy transfer

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