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Luminescence of Rare-Earth-Doped Nanoparticles with Aromatic Linker Molecules TESS SENTY, MOHITA YALAMANCHI, YANWEI ZHANG, ANYA LEACH, MOHINDAR SEEHRA, XIAODONG SHI, ALAN BRISTOW, West Virginia University — Rare-earth-doped vanadate glasses retain their luminescence when formed as shells around magnetic cores [1]. This property has prompted speculation that composite magneto-photoluminescent (CMPL) structures can be used in biological applications. For example, CMPL nanoparticles can be magnetically tuned to separate cells, proteins and nucleic acids [2]. A crucial step in realizing this goal is to attach organic linkers (between the rare-earth-doped shell and bio-probes), which do not affect the luminescence. We demonstrate with IR spectroscopy that Eu:YVO_4 nanoparticles treated with benzoic acid, 3-nitro 4-chloro-benzoic acid and 3,4-dimethoxy benzoic acid all result in the modification of the surface states, replacing the native metal-hydroxyl bond with a longer chain aromatic linker, which can be later functionalized. Photoluminescence spectra under UV-excitation show that the dominant $^5D_0 \rightarrow {}^7F_2$ transition at ∼620 nm is unaffected by the chemical treatment. The result provides a platform to facilitate the attachment of bio-probes to Eu:YVO_4 nanoparticles and related CMPL nanostructures with Fe_2O_4 cores.
[1] N. B. McDowell et al, J. Appl. Phys. 107, 09B327 (2010).
[2] T. R. Sathe et al, Anal. Chem. 78, 5627 (2006).

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