Mixed terbium and europium complex for photoluminescent pressure sensing

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Photoluminescent lanthanide-based composites have been extensively researched for their application in pressure-sensing technology. Their key attributes, including versatile functionality, cost-effectiveness, and high optical efficiency, position them as a pivotal category within the realm of photoluminescent sensors. Recent findings highlight the high-range pressure-sensing capabilities of Yb^{3+}/Er^{3+} doped upconversion nanoparticles. The compression-induced reduction in interionic distances within the structure triggers alterations in Ln-Ln energy transfer. Consequently, this leads to modifications in the lifetime, intensity ratio, and brightness of the Ln^{3+} emitter under applied pressures of up to 5 GPa.[1,2] This investigation specifically delves into the realm of low-range (< 1 GPa) pressure-sensing photoluminescent materials, targeting their application in tribological pressure measurement [3]. The Ln-based complex is designed to offer a softer structure compared to the pure inorganic matrix, aiming to optimize sensitivity in the low-pressure range. The energy transfer dynamics between two Ln^{3+} entities exhibit pressure-dependent variations, resulting in corresponding changes in relative intensity with pressure. The energy transfer between two Ln^{3+} varies with pressure, so the relative intensity changes with pressure. The demonstrated high sensitivity, reversibility, and reproducibility underscore the considerable potential of this material as a self-calibrated sensor for pressure sensing applications.

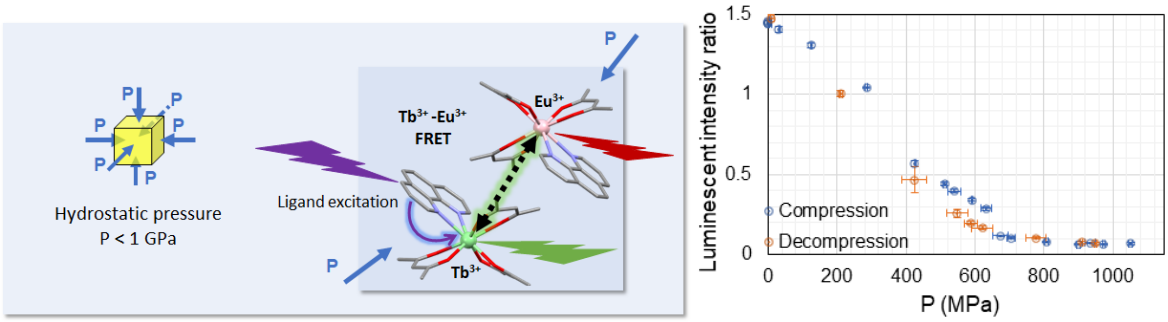

Figure 1 Scheme of the mixed europium and terbium complex under pressure and luminescent intensity ratio as a function of applied hydrostatic pressure (up to 1 GPa).

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Mots clés : photoluminescence, complexes de lanthanides, pressure sensing.