

# New Isomeric ancillary ligand and their Eu<sup>III</sup> complexes: A single component white light emissive phosphor and their applications in Red/White smart LEDs, Electronic Noses and Temperature sensing†

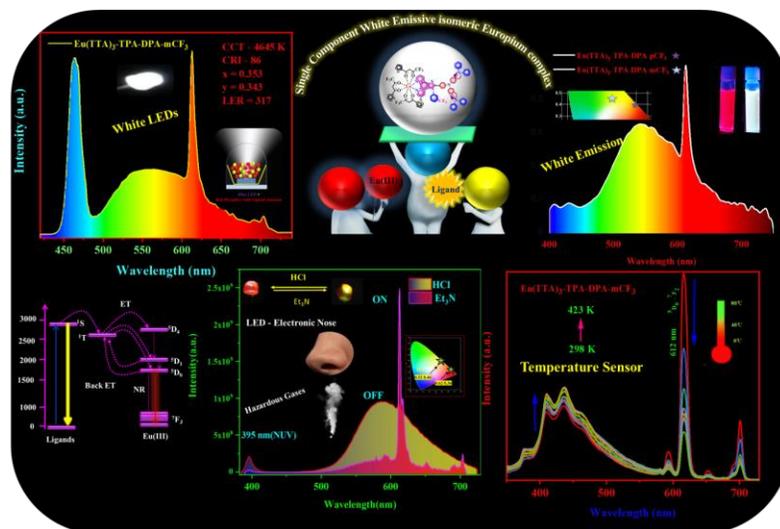
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†Dedicated to Prof. D. Gajapathy on the occasion of his 75<sup>th</sup> birthday.

**Abstract:** Two isomeric ligands were designed and synthesized for Eu(III) complexation. The purposely designed ancillary ligands show greenish-yellow emission in the solution as well as in solid state. However, the corresponding Eu-complex based mCF<sub>3</sub> functionalized showed single component white light emission with balanced color purity, in contrast, the pCF<sub>3</sub> functionalized Eu-complex showed pure red emission.



Extremely narrow band red emission with full width at half maximum (FWHM) of 5-6 nm (asymmetric ratio (AR) 12-14, color purity 92-93%) was observed with 335 nm light excitation (blue ~445 nm for ligands) and could be potential for solid state lighting. The systematic solvatochromism study reveals that the Eu(TTA)<sub>3</sub>-TPA-DPA-mCF<sub>3</sub> show multi-color /tunable emission with variable CIE color coordinates, in contrast Eu(TTA)<sub>3</sub>-TPA-DPA-pCF<sub>3</sub> shows pure red emission. The mechanism suggests that the partial and complete energy transfer from ligand to Eu(III) ion is responsible and supported by theoretical as well as experimental study. Both the complexes have applied as a potential phosphor for red/white LEDs fabrication and particularly Eu(TTA)<sub>3</sub>-TPA-DPA-mCF<sub>3</sub> is applied for white LEDs fabrication in conjugation with blue LED. The white LED produced superior white emission (CIE = 0.35, 0.34) with CRI = 86 %) and CCT = 4645K, whereas near UV conjugated white LED showed CRI of 78 %. In addition, to illustrate the prospective use of the scheme in sensor applications, the red fabricated LED can be applied for visual detection of acid and bases vapors (act as electronic noses) from the environment due to emission swapping characteristics. Dual emission behavior of complex lead to study the thermometric property in higher temperature ranges (RT to 180°C) and calculated the sensitivity (Sr) to be 6.74% which is highest among reported one.

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