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# White Light Emission from Carboxymethyl Cellulose Films loaded with $Eu^{3+}$-Doped $NaGdF_4$ Particles towards Photonic Applications

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This work focuses on the synthesis of $NaGdF_4$ particles doped with 25% $Eu^{3+}$ using a hydrothermal method, followed by their dispersion into carboxymethyl cellulose (CMC) for potential photonic applications. Structural analysis confirmed the formation of pure β-$NaGdF_4$ crystalline particles with a hexagonal crystal structure, validated by X-ray diffraction (XRD). Uniform rod-like particles, ranging in size from 600 nm to 1.1 microns in length and 200 nm to 350 nm in width were observed by Transmission electron microscopy (TEM), as well as their dispersion into the CMC films. The $Eu^{3+}$ emission spectra were obtained under excitation at 394 nm, and the typical $^5D_0 \rightarrow {}^7F_J$ (J = 0, 1, 2, 3 and 4) electronic transitions, in the red region, were observed. Besides, transitions from the $^5D_1$ excite state were observed due to the location of $Eu^{3+}$ ions into low phonon energy host.

Self-supported films were prepared by dispersion of β-$NaGdF_4$: $Eu^{3+}$ in CMC, to investigate their potential in creating functional polymer composites. A broad-band emission from the polymer matrix (400-550 nm) complemented the red emission from the $Eu^{3+}$ ions (Fig. 1A) to origin the white emission from the films, which is visible to the naked eye and confirmed by the x and y coordinates on the CIE 1931 Chromaticity diagram (Fig. 1B).

These initial findings indicate that β-NaGdF4 particles, when dispersed in CMC, hold promising potential for various photonic applications, depending on the doping ion. These applications range from serving as emitters and energy converters for temperature sensing, to functioning as flexible waveguides[1], and possibly even as organic light-emitting diodes (OLEDs).

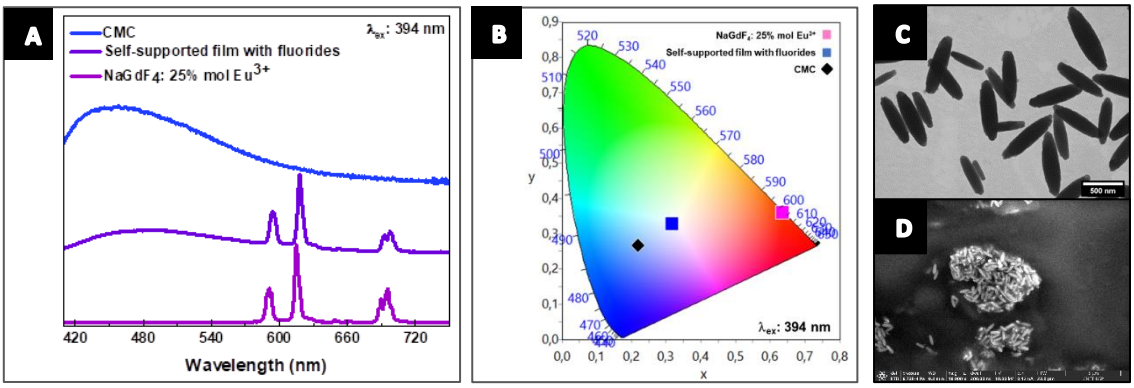


**Fig 1. a)** Emission spectra and **b)** Chromaticity diagram CIE 1931 of $NaGdF_4$:$Eu^{3+}$ particles, CMC pure and particles in CMC, under UV excitation c) MET image of NaGdF4 particles d) SEM image of self-supported film with particles.

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**References**

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