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Long blue phosphorescent lifetime of the new Gd(III)-imidate complexes

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Phosphorescent materials have significant interest due to their applications in emerged technologies such as bioprobes, bioimaging, displays, and molecule sensing. Organic luminophores with long phosphorescence lifetimes are highly valued thanks to their biocompatibility, environmental friendliness, and flexible structures [1]. A strategy to enhance the phosphorescent properties and increase the luminescence lifetime of these organic compounds is to preparate coordination complexes with metal ions that present strong spin-orbit coupling [2,3]. This work reports a new classes of Gd(III)-imidate complexes as prolonged phosphorescent lifetime materials. The syntheses of the complexes were performed using mechanochemistry in a Turrax device. All reactions used 0.4 mmol of $GdCl_3 \cdot 6H_2O$, 1.2 mmol of ligand, 1.2 mmol of NaOH, and 25 µL of distilled water, which were milled for one hour (Figure 1a). The synthesized complex with *N*-acetyl-4-methoxybenzamide exhibits a blue afterglow emission at 77 K, visible to the naked eye for approximately 4 s after the UV irradiation (λexc = 312 nm) is switched off (Figure 1b). Time-resolved emission spectra at 77 and 298 K were obtained with a several delay times, presenting maximum at 434 and 456 nm (Figure 1c), typical of a blue emission. The phosphorescence lifetime was estimated by a monoexponential fit to the decay kinetics profile (Figure 1d) that yielded a value of 0.448 ± 0.011 s (R^2 = 0.995). This result is very promising because the literature shows a La(III)-TTA complexes with an ancillary ligand (bispyrazolyl-1,3,5-triazinyl derivative) presented phosphorescence lifetime of up to 2.2 s in solid-state at 10 K [3]. Thus, the synthesized compound has interesting perspectives for designing new lanthanide complexes with imides using an auxiliary ligand with ultralong lifetime phosphorescence.

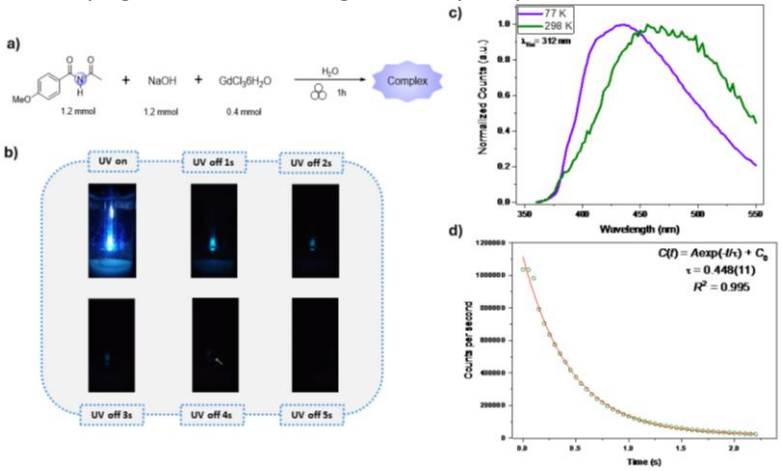

Figure 1: a) General synthesis. b) Emission at room light after irradiation with UV light at 312 nm. c) Emission spectra at 77 and 298 K, d) Emission decay kinetics profile.

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References:

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