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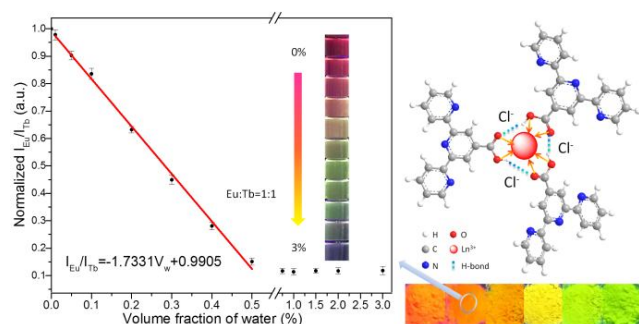


# Color-Tunable Luminescent $\text{Ln}^{3+}$ composite as Self-Referencing and Ratiometric Sensor for Low-Level Water Detection in Ethanol

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## Graphical abstract



A new color-tunable luminescent  $\text{Ln}^{3+}$  ( $\text{Ln}=\text{Eu}$ ,  $\text{Tb}$  or  $\text{Eu}$  and  $\text{Tb}$  in different molar ratio) composite was prepared through a simple method, which can be applied as self-referencing and ratiometric sensor for detecting low-level water content (0.01-0.5 vol%) in ethanol.

## Research Highlights:

1. A novel  $\text{Ln}^{3+}$  ( $\text{Ln}=\text{Eu}$ ,  $\text{Tb}$  or  $\text{Eu}$  and  $\text{Tb}$  in different molar ratio) complex with tunable luminescence from red to green was prepared through a simple procedure;
2. The luminescence color of the  $\text{Eu}/\text{Tb}$  co-doped complex can be tuned by water through the luminescence quenching mechanism as well as the variation of energy transfer efficiency from  $\text{Tb}^{3+}$  to  $\text{Eu}^{3+}$ ;
3. The complex with  $\text{Eu}^{3+}:\text{Tb}^{3+}=1:1$  can be applied as self-referencing and ratiometric luminescent sensor for detecting low-content water (0.01-0.5 vol%) in ethanol.

**Abstract:** Developing simple, fast and sensitive detection of low-level water in organic solvents is in high demand for academic and industrial applications. In this paper, a novel color-tunable lanthanide composite has been prepared by simply mixing 2,2':6',2''-terpyridine-4'-carboxylic acid (Hctpy) and  $\text{Ln}^{3+}$  with a molar ratio of 3:1 in absolute ethanol at room temperature, in which the  $\text{Ln}^{3+}$  ions are mainly coordinated with carboxyl moieties rather than with terpyridine moieties of Hctpy. In addition, the emission colors of the composite can also be tuned by water, ascribed to the luminescence quenching mechanism and the variation of Tb-to-Eu energy transfer efficiency. Based on these properties, a self-referencing and ratiometric luminescent water detector with the  $\text{Eu}/\text{Tb}$  molar ratio of 1:1 has been

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