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

Authors: Tianren Wang, Meiqi Liu, Yige Wang

PII: S0025-5408(17)32513-8
DOI: http://dx.doi.org/doi:10.1016/j.materresbull.2017.08.022
Reference: MRB 9500

To appear in: *MRB*

Received date: 29-6-2017
Revised date: 9-8-2017
Accepted date: 9-8-2017

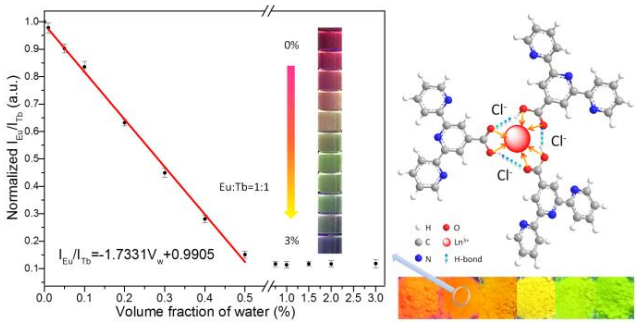
Please cite this article as: Tianren Wang, Meiqi Liu, Yige Wang, Color-Tunable Luminescent Ln3+ composite as Self-Referencing and Ratiometric Sensor for Low-Level Water Detection in Ethanol, Materials Research Bulletinhttp://dx.doi.org/10.1016/j.materresbull.2017.08.022

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

Tianren Wang, Meiqi Liu and Yige Wang*

Hebei Provincial Key Lab of Green Chemical Technology and High Efficient Energy Saving, School of Chemical Engineering and Technology, Hebei University of Technology, Tianjin, 300130, China, E-mail: wangyige@hebut.edu.cn

Graphical abstract



A new color-tunable luminescent Ln^{3+} (Ln=Eu, Tb or Eu and 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 Ln^{3+} (Ln=Eu, Tb or Eu and 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 Eu/Tb co-doped complex can be tuned by water through the luminescence quenching mechanism as well as the variation of energy transfer efficiency from Tb^{3+} to Eu^{3+};
3. The complex with Eu^{3+}: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 Ln^{3+} with a molar ratio of 3:1 in absolute ethanol at room temperature, in which the 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 Eu/Tb molar ratio of 1:1 has been