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Color Tunable Emission and Low-temperature Luminescent Sensing of Europium and Terbium Carboxylic acid Complexes

Xianju Zhou*, Lingni Chen, Zhongshan Feng, Sha Jiang, Jinzhao Lin, Yu Pang, Li Li, Guotao Xiang

School of Science, Chongqing University of Posts and Telecommunications, Chongqing, 400065, P.R.China

Abstract: A series of lanthanide organic complexes, namely, $\text{Eu}_x\text{Tb}_{1-x}$ (BTC) ($x=0$: complex **1**, 0.01: complex **2**, 0.05: complex **3**, 0.1: complex **4**, 0.4: complex **5**, 1: complex **6**, $\text{H}_3\text{BTC} = 1, 3, 5$ -benzenetricarboxylic acid), have been synthesized. The overall quantum yields (Φ_{overall}) of luminescence for complex **1** is detected to be as high as 95%, while that for complex **6** is only 8%. It hints the ligand is more suitable to pump Tb^{3+} ions than Eu^{3+} . Energy transfer from Tb^{3+} to Eu^{3+} is observed in Eu,Tb bi-nuclear compounds (complexes **2-5**), which leads to tunable emission color from green to yellow, and then to red under the excitation of UV lamp. It indicates them as promising light emitting materials potentially. The temperature dependence of the fluorescence intensity ratio between the green emission of Tb^{3+} and the red emission of Eu^{3+} was investigated in the range of 25-300 K for complexes **2-4**. The largest relative sensitivity S_R is found to be $0.42\%K^{-1}$, $1.46\%K^{-1}$ and $0.35\%K^{-1}$ at 300 K respectively. It hints the binuclear lanthanide complexes could be served as potential optical thermometry materials.

Keywords: metal organic complex, emission tunable, energy transfer, thermometry

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