Building Highly Content Responsive Optical Thermometer attached to the Intervalence Charge Transfer States Bridged Thermal-coupled Levels

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Abstract: Optical thermometer based on the ratio of thermal-coupled levels (TCLs) has long time been suffering from the low spectral resolution and limited temperature sensitivity, which forms the major barrier for higher sensing performance. To address this problem, we have proposed a novel strategy to bridge Tm^{3+}($^1D_2$) and Eu^{3+}($^5D_1$) configurations, wherein the intervalence charge transfer states are applied to relate the blue and red emissions. Naked eye recognized photochromic variation is observed between red and blue with increasing temperature. Compared to the conventional TCLs, the relative temperature sensitivity of this proposed strategy presents violent response to the lanthanide concentration, increasing from 5.56 to 10.1% K^{-1} with Eu^{3+} molar concentration rising from 0.3 to 0.5 mol%. This strategy demonstrates a new path to construct TCLs crossing lanthanide elements, and sheds light on promoting the performance of optical thermometers.

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