

Fine tuning the microenvironment of $[\text{EuW}_{10}\text{O}_{36}]^{9-}$ anion leads to the large enhancement of the red light luminescence

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Abstract

The polyoxometalate (POM) anion of europium (III) decatungstate $[\text{EuW}_{10}\text{O}_{36}]^{9-}$ exhibits great luminescence quantum yields of approximately 67% but suffers reduced red light emissions that are due to the low ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ transmissions. Fine tuning the microenvironment around $[\text{EuW}_{10}\text{O}_{36}]^{9-}$ anion through intercalation into different compositions of layered double hydroxides (LDHs) materials, greatly enhances the ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ transmissions. The positive nanosheets in LDHs provide a conducive microenvironment for strong transitions of ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ to occur. The ratio $I({}^5\text{D}_0 \rightarrow {}^7\text{F}_2)/I({}^5\text{D}_0 \rightarrow {}^7\text{F}_1)$ for the observed intensities vary from 0.44 for $[\text{EuW}_{10}\text{O}_{36}]^{9-}$ ion to 14.08, 6.20, 1.75 and 1.59 in $\text{Mg}_2\text{Al-EuW}_{10}\text{O}_{36}$, $\text{LYbH-EuW}_{10}\text{O}_{36}$, $\text{Zn}_2\text{Al-EuW}_{10}\text{O}_{36}$ and $\text{LEuH-EuW}_{10}\text{O}_{36}$ materials respectively (Mg_2Al = magnesium aluminum LDHs, Zn_2Al = Zinc aluminum LDHs, LYbH = layered ytterbium hydroxide LDHs, and LEuH = layered europium hydroxide LDHs). As such, these materials can find a wide application in processes that require the red light luminescence

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