Enhancement of near infrared upconversion in $LuNbO_4:Yb^{3+},Tm^{3+}$ with Ga^{3+} and Ta^{5+} substitutions

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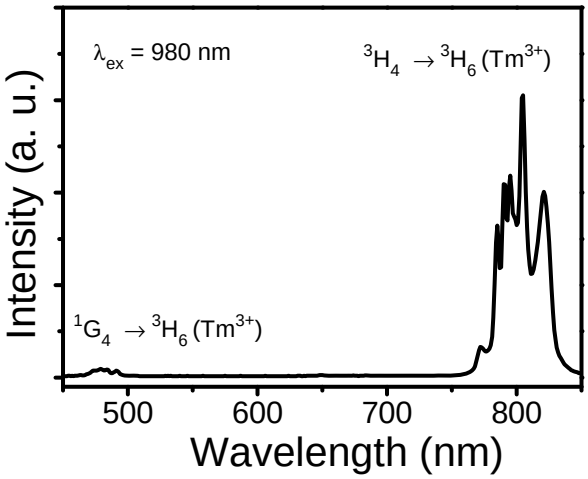
Yb^{3+} and Tm^{3+} co-doped upconversion (UC) phosphors typically exhibit near infrared (NIR) emissions and have attracted great attention because of the advantages for bio-applications[1,2]. In this study, we investigated the UC luminescence of $LuNbO_4:Yb^{3+},Tm^{3+}$ with Ga^{3+} and Ta^{5+} substitutions. Under 980 nm excitation, the UC spectra of $LuNbO_4:Yb^{3+},Tm^{3+}$ predominantly exhibited NIR emission bands at approximately 805 nm, whereas other UC emissions including a greenish-blue emission were insignificant. The UC emissions originated from Tm^{3+} via an energy transfer from Yb^{3+} to Tm^{3+}. A two-photon process was responsible for the NIR UC emission. Ga^{3+} and Ta^{5+} ions were substituted for Lu^{3+} and Nb^{5+} ions, respectively, resulting in the enhancement of the NIR UC emissions. These findings were explained using the modification of the local crystal structure and the crystal field asymmetry surrounding the Tm^{3+} ions. The results demonstrated that $(Lu,Ga)(Nb,Ta)O_4:Yb^{3+},Tm^{3+}$ has a high potential for NIR UC phosphors.

Figure 1: UC spectra of $LuNbO_4:Yb^{3+},Tm^{3+}$.



Bibliography

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