# Investigation of the quenching mechanisms of $Tb^{3+}$ doped scheelites

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Scheelites are $ABO_4$ compounds for which a variety of ions can be chosen for A and/or B cations. Some among these scheelites show intrinsic luminescence and doping with rare earth elements results in additional 4f-4f emission. Here, the investigated material was $PbWO_4:Tb^{3+}$. The host emission consists of two emission bands, in the blue and green region respectively, however strongly suppressed by the $Tb^{3+}$ emission, including transitions from the $^5D_4$ and $^5D_3$ level.

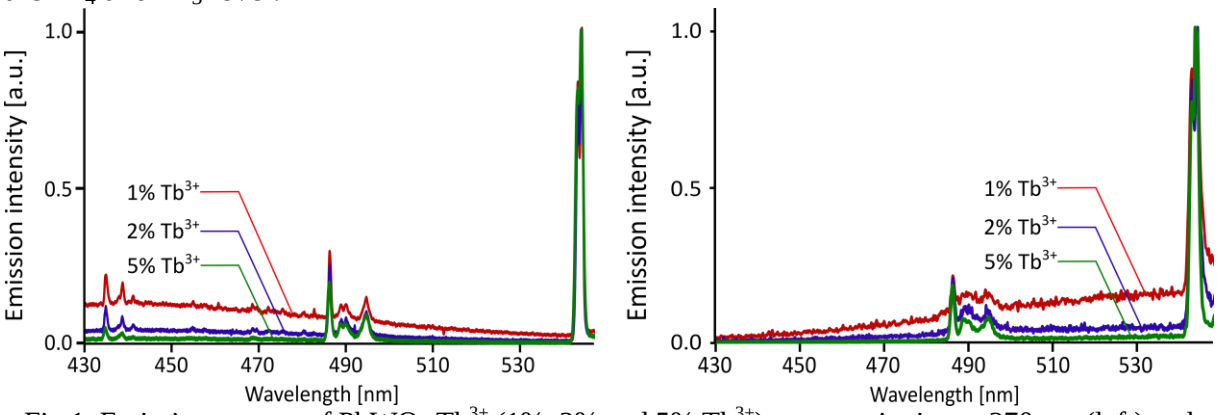
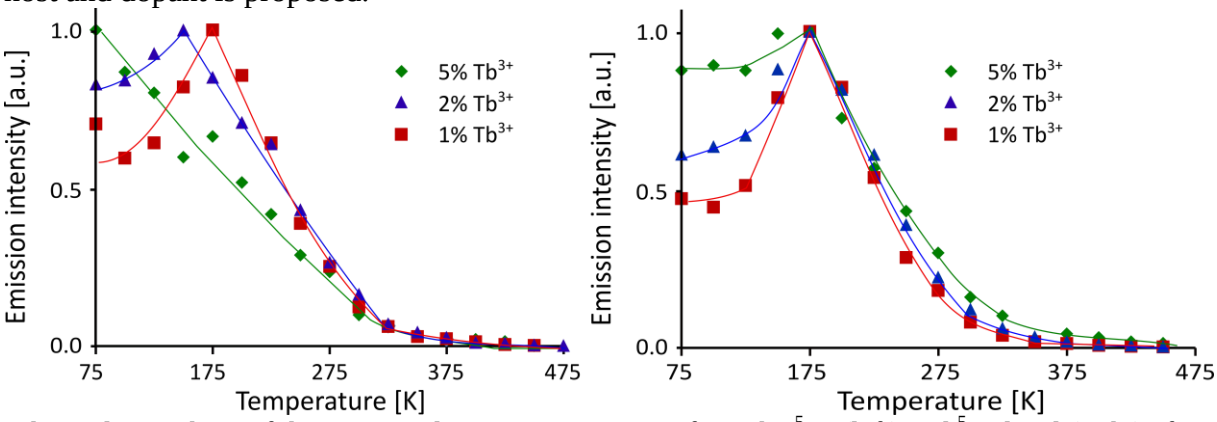



Fig 1. Emission spectra of $PbWO_4:Tb^{3+}$ (1%, 2% and 5% $Tb^{3+}$) upon excitation at 270 nm (left) and 320 nm (right) at 10K.

Both the host emission and the $Tb^{3+}$ emission possess a strong temperature dependence. Elucidation of this behavior is not straightforward as several transfer mechanisms are involved. The thermal quenching profiles of both the host emission and the $Tb^{3+}$ emission are recorded for different excitation wavelengths, making the distinction between host excitation and direct excitation into the 4f-levels of $Tb^{3+}$. Divergent quenching profiles of the host emission for the un-doped versus doped materials reveal a temperature dependent energy transfer process from the host towards the $Tb^{3+}$ ions. Performing these measurements for samples with different $Tb^{3+}$ concentrations allowed discriminating between the different processes involved. In addition, time resolved measurements are carried out to unravel the energy transfer mechanisms. Based on the available data a detailed energy level scheme of host and dopant is proposed.




Thermal quenching of the integrated emission intensities from the $^5D_3$ (left) and $^5D_4$ level (right) after excitation in the host ($\lambda_{exc}$ = 270 nm). The solid lines serve as a guide to the eye.