Dynamics and the enhancement of the persistent emission

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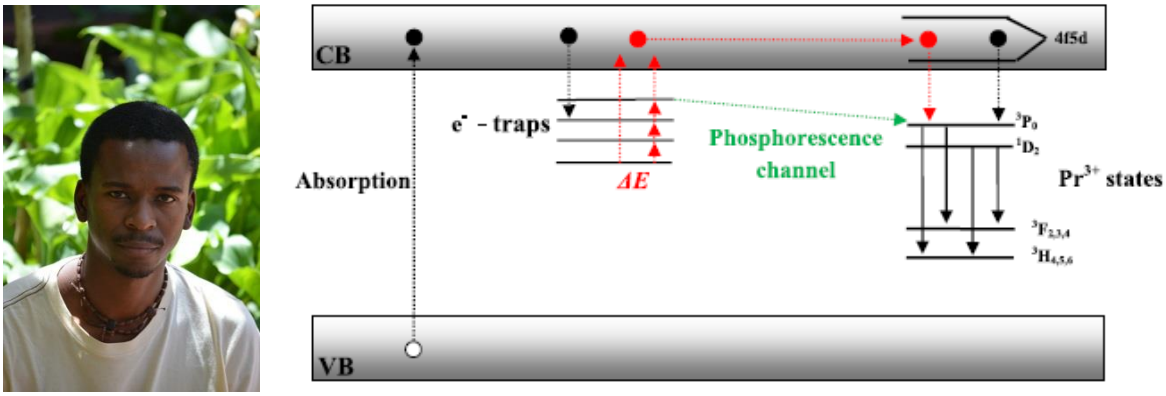

Figure 1: Schematic representation of the persistent emission of phosphors.

The study focuses on the dynamics of persistent emission of $ZnTa_2O_6:Pr^{3+}$ related phosphors. The persistent nature of the emission is aided by the presence of oxygen vacancies, which act as electron trapping centers (Fig. 1). The trapping is attributed to the coulombic force that exists between the positive oxygen vacancies and the electrons in the conduction band (CB), which are populated upon exciting electrons from the valence band (VB). The trapped electrons are later thermally excited back to the conduction band at room temperature, from where they will de-excite to the Pr^{3+} luminescence centre. The long route travelled by these electrons is responsible for persistent emission. In our study we enhanced the lifetime of the persistent emission by generating more oxygen vacancies using Li_2SO_4 and Li_2CO_3 to prepare our phosphor. The enhancement of oxygen traps are as revealed from the signals in the TL spectra in figure 2b, which were not present in Figure 2a. The role of persistent emission is currently observable in self glowing paints, biological imaging, and self-lit emergency signs. The greatest impact will be in generating a light bulb which will be excited by sunlight during the day, and will continue glowing throughout the night without costing a single cent.

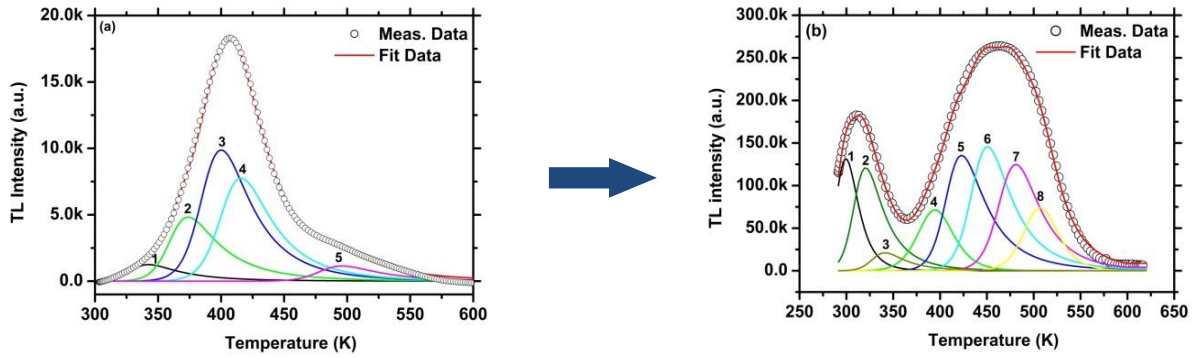

Fig. 2: Glow curves showing additionally generated electron traps in $ZnTa_2O_6:Pr^{3+}$