Temperature and wavelength dependent trap filling in $SrAl_2O_4$:Eu,Dy

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Persistent luminescent phosphors are photoluminescent materials that keep emitting light for minutes or hours after the termination of the excitation. This peculiar phenomenon is the result of at least two kinds of active centers in the phosphor, a luminescence center and a trapping center, and of the temperature dependent exchange of charge carriers between these centers [1].

Strontium aluminate doped with europium and dysprosium ($SrAl_2O_4$:Eu,Dy) is one of the most widely used persistent luminescent phosphors. At room temperature, it features a broad green emission band and bright long-lasting afterglow. At low temperatures (< 250 K) a second, blue emission band becomes visible (Fig. 1) for which the origin is still subject of debate.

To investigate the origin of this blue emission band and its role in the persistent luminescence trap filling process (Fig. 2), we performed a dedicated study on $SrAl_2O_4$:Eu,Dy in which we combined temperature dependent charging and afterglow measurements with thermoluminescence measurements, using different excitation wavelengths.

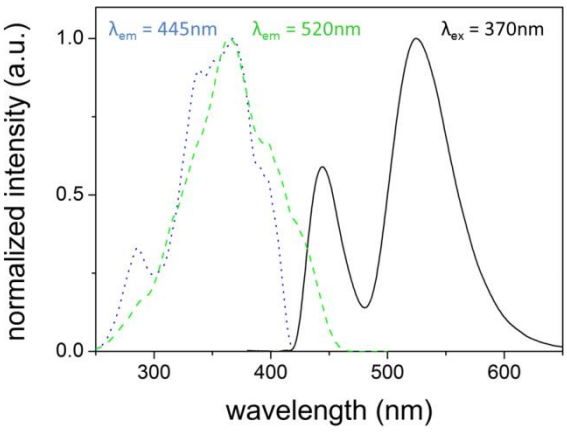

Fig. 1: Emission spectrum (solid line, λ_{ex} = 370 nm) and excitation spectra (blue dotted line, λ_{em} = 445 nm and green dashed line, λ_{em} = 520 nm) of $SrAl_2O_4$:Eu,Dy at 10 K.

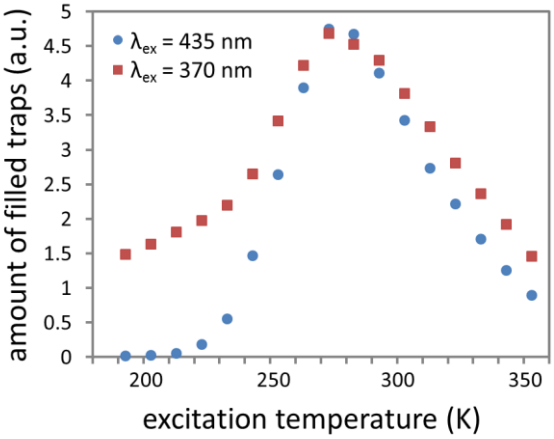

Fig. 2: Amount of filled traps after excitation during 15 min at different temperatures. (red squares, λ_{ex} = 370 nm and blue circles, λ_{ex} = 435 nm)

[1] K. Van den Eeckhout, P.F. Smet, D. Poelman, Materials 2010, 3, 2536-2566.