Instructions for practical work concerning the lecture

"Optical and Electrical Characterization of Materials"

"Materialcharakterisierung"

Group size: Two students

Workload: about 15 hours

Practical work supervisor: Dr. David Enseling (Room: M8 (Grips II) and C255k)

The report to this practical work must be submitted by February, 15st 2023.

Each group receives a phosphor batch. The group records the decay time at room temperature and the thermal quenching of the emission in the temperature range of 100 to 500 K of this phosphor.

Before the start of the practical work at the fluorescence spectrometer, a literature search regarding the phosphor has to be performed. The group has to search for information on the emission and excitation wavelength, thermal quenching temperature and decay time of the phosphor.

The general functional principle of a fluorescence spectrometer has to be known.

The spectroscopic measurements will require about 5 hours.

To evaluate the data, the group will plot the thermal quenching data (integral of the emission intensity versus temperature) and fit the curve with a Boltzmann function.

$$I(T) = \frac{I_0}{1 + D * e^{\frac{-E_A}{kT}}}$$

Boltzmann equation: $I(T)$ = emission integral at temperature T, I_0 = emission Integral at 0 K, D = frequency constant, E_A = quenching energy, k = Boltzmann constant, T = temperature

From this fit the $T_{1/10}$, $T_{1/2}$ and $T_{9/10}$ values of the phosphor can be calculated.

($T_{1/n}$ value = the value at which the emission integral has dropped to $1/n$ of the max. value)

The report should include a brief explanation in how far knowledge of the decay and the thermal quenching properties of a phosphor is useful. Furthermore, an error estimate (-calculation) has to be made for both measurements. Finally, the measurement results should be compared with the literature values and possible deviations be explained.

Please appear in groups of two at Dr. David Enseling's office to receive the phosphor and allocate a date for the measurements.