

Master's Project – Title:

Synthesis of Lanthanide-Doped Perovskite Nanocrystals

Motivation

All-inorganic and hybrid perovskite nanocrystals (NCs) with the general formula $MPbX_3$ (where M can be either a large inorganic or organic cation and X a halide – Cl-, Br-, or I-) have recently emerged as an important class of luminescent nanomaterials. Indeed, the latter are characterized by three remarkable optical characteristics such as i) a high photoluminescent quantum yield, which can be reached without performing post-synthetic treatments; ii) relatively narrow emission lines with full width at half-maximum typically below 100 meV; and iii) photoluminescence that is tunable across the entire visible spectral range simply by adjusting the band gap when modifying the ratio of halide anions in the crystal structure. Such impressive properties led to a huge attraction from researchers worldwide to finely tune the optical characteristics of perovskite NCs to perfectly fit the requirement of key technological applications such as LEDs, lasers, displays, solar cells, or photodetectors.



The project is focused on the controlled synthesis of perovskite NCs doped with trivalent lanthanide ions to introduce additional radiative relaxation channels of excitons and thus modify the corresponding optical characteristics. The main challenge of this project is to deliver highly monodisperse perovskite NCs with dopants fully integrated into the crystal structure.



Perovskite NCs (top) are synthesized by an organic method involving the use of a glovebox (bottom left) and a Schlenk line (bottom right).

Aufgabe

The “Luminescent Nanocrystals” group is part of the “Nanophotonics for Energy” division that was established at KIT in 2014 within the Institute of Microstructure Technology (IMT) and the Light Technology Institute (LTI). We are working on the development of luminescent nanocrystals for energy (light harvesting) and medical (luminescent nanoprobes for diagnosis and surgery) applications.

We are currently looking for a highly motivated master student to synthesize and characterize perovskite NCs. This project involves the following tasks:

- Synthesizing perovskite NCs (glovebox and Schlenk line)
- Structural and optical characterization of the synthesized NCs

Various perovskite NCs will be synthesized by changing the chemical nature of dopants (trivalent lanthanides).

Voraussetzung

- a. Chemistry knowledge (both organic and inorganic)
- b. Materials Science knowledge (powder x-ray diffraction, TEM)
- c. Keen to learn how to synthesize luminescent nanocrystals and measure their corresponding optical properties

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Forschungsabteilung

“Nanophotonics for Energy”
division of IMT / LTI

Ausrichtung

Experimental

Studiengang

Chemistry
Materials Science

Einstieg

From: ASAP

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