

FINAL MASTER PROJECT PROPOSAL



Title

Synthesis and Advanced Transmission Electron Microscopy characterisation of AgBiS₂ nanoparticles for photovoltaics: influence of nanostructure on solar cell performance.

Supervisor(s)

Dra. María Bernechea
Dr. César Magén

Summary of the project

Colloidal AgBiS₂ nanocrystals have shown interesting properties and promising performance in non-toxic solution-processed solar cells. Preliminary results show that different synthetic conditions lead to different nanocrystal properties (size, shape, composition), and this affects photovoltaic performance. Moreover, different analyses show that Ag and Bi cations are not homogeneously distributed in the nanocrystals and Ag cations tend to accumulate on the surface.

This project will focus on the synthesis and detailed characterisation of AgBiS₂ nanocrystals using transmission electron microscopy techniques (HRTEM, EELS, EDX, HAADF). The aim is to develop tools to analyse the cation disposition on the nanocrystals and their influence in solar cell performance.

MAIN TASKS of the project:

- Literature review. Colloidal nanocrystals: concept, synthesis, use in photovoltaics. Characterization techniques: TEM.
- Synthesis and characterisation of AgBiS₂ colloidal nanocrystals. Use of different conditions. Standard chemical and structural characterisation.
- Sample preparation for TEM: Ligand removal techniques, analysis of sample stability under measurement conditions.
- TEM characterisation of different AgBiS₂ nanocrystals using HRTEM, HAADF-STEM imaging and EELS/EDX using cutting-edge aberration-corrected Titan microscopes of the LMA at INA.
- Conclusions and prospects.

Requirement of 2 supervisors: this TFM requires supervision and training on complementary skills. While Dr. Bernechea is an expert in the synthesis of colloidal nanoparticles for photovoltaics, Dr. Magén is specialized in advanced TEM characterization of functional nanomaterials.