Project 3.2. Development of strategies for improving stability of lead halide perovskites

Supervisor: Dr hab. inż. Daniel Prochowicz

ICP PAS Group: Semiconductor Materials and Optoelectronic Devices

Background:

Lead halide perovskites belong to a class of inorganic or inorganic-organic compounds with the general formula of ABX3 and exhibits a cubic crystal structure. These semiconductor materials have attracted increasing attention and exhibit unique physicochemical properties such as tunable band gaps, high absorption coefficients, high carrier mobilities and long carrier lifetimes. Moreover, due to their easy thin film fabrication process lead halide perovskites appear as excellent materials for the fabrication of new generation of solar cells. However, the low stability of lead halide perovskites under high thermal, moisture and operational conditions are issues that needs to be addressed. In this context, a great deal of current interest in the perovskite community and chemistry has been focused on the understanding of chemical instability of lead halide perovskites and developing strategies for stable perovskite compositions and more robust perovskite-based optoelectronic devices.

Aim:

The overall goal of this project is to develop advantageous methods for the preparation of new lead halide perovskite compositions showing high stability in high humidity and elevated temperature conditions for application in photovoltaic. To realize the aims, perovskite systems with 2D layered structure, mixed 3D/2D structure and all-inorganic lead-halide $CsPbI_{3-x}Br_x$ compositions will be designed and synthesized. Integral part of the research will be the structural and optical characterizations and analysis of defect density, ion motions and activation energy levels in resulted perovskites with the help of electrochemical impedance spectroscopy under different conditions of light and temperature. The proposed research tasks within this project belong to current global research trends and open new perspectives and possibilities for the synthesis and characterization of lead halide perovskites. As a result, the resulting compounds will contribute to the fabrication of stable and efficient optoelectronic devices i.e. solar cells and photodetectors.

Requirements:

- a university degree in chemistry, a MSc. degree in chemistry or related sciences.
- experience in laboratory work in the field of inorganic and coordination chemistry.
- good knowledge of basic characterization techniques e.g. PXRD, UV-vis, PL, NMR, IR.
- experience in laboratory work with glovebox system.
- good command in English (written and spoken).
- motivation for scientific work.