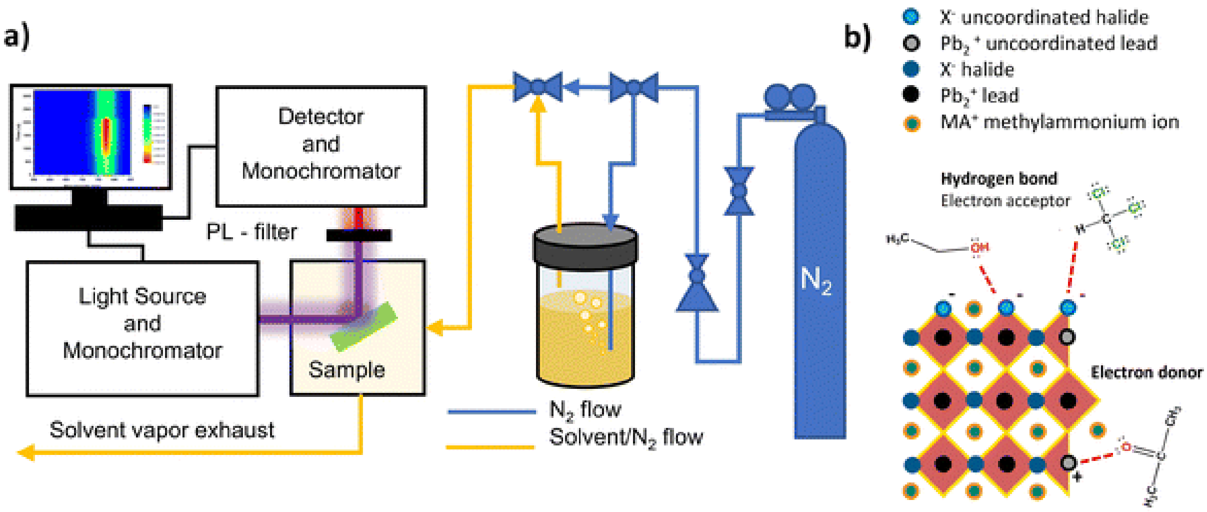
Combining perovskites and modified low dimensional materials for advanced photovoltaic applications

Final report
(early termination 2024.01.05.)

The aim of the project was to address the instability issues of perovskite solar cells. We were planning to incorporate low dimensional carbon materials into the layered solar cell structure. Our strategy was to investigate the properties of each component separately. Also we were planning the characterization of the devices under working environment.

In the first year of the project, we focused on the stability of perovskites against common solvents used in perovskite device fabrication. We applied the wapor of these chamicals while in-situ monitoring the cahnge in the photoluminescence spectra.

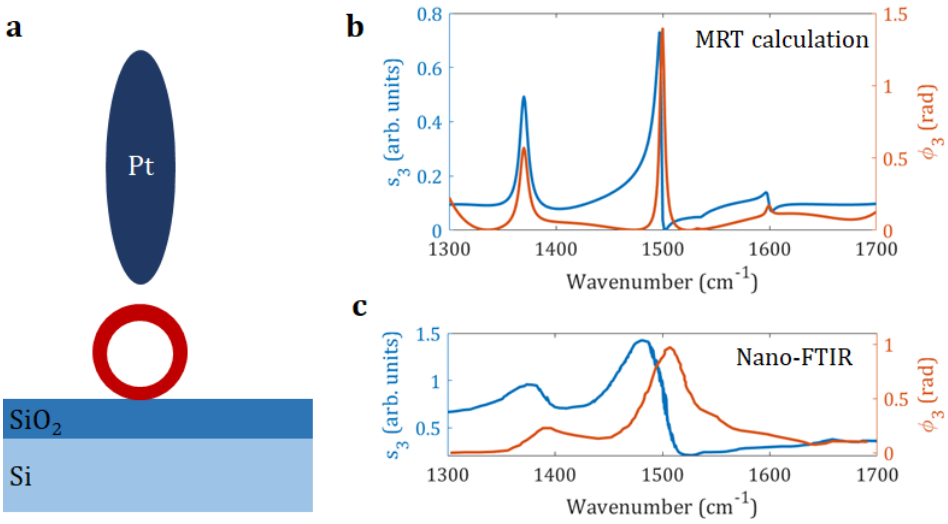


The results helped us to elucidate some aspects of the environmental sensitivity of perovskites which led to the creation of more stable perovskite samples for further investigations [1].

Unfortunately Mehmet Derya Özeren – responsible for the sample preparation - left our group. Perovskite sample preparation is a delicate process. There are various hidden parameters which can heavily affect the final quality of the sample. While we tried our best to continue the sample preparation based the detailed description we were not able to reach the desired stability.

While looking for good candidates to join the project with necessay chemistry background we continued the investigation of perovskite stability issue on the nanoscale level. Using a scattering type nearfield infrared microscope (s-SNOM) we were able to measure spectral properties of the material with 20nm spatial resolution. Unfortunately after the completion of the PhD our colleague Gergely Német responsible for the nearfield measurement left the group.

Without proper samples we have turned to theoretical questions, and started to develop a robust model for the description of the nearfield scattering process. We have utilized the general Mie-scattering theory for nearfield scattering. The theoretical description and modelling of this novel measurement technique is still evolving, and we were able to ontribute with a tool which can handle arbitrary geometries[2].



We were able to recreate qualitatively the experimental features of the nearfield spectrum.

The last year the Principal Investigator – Áron Pekker – decided to terminate his contract with Wigner RC. Due to these circumstances we have applied for the early termination of the project as of 2024.01.05.

1. Mehmet Derya Özeren, Áron Pekker,Katalin Kamarás, Bea Botka: Evaluation of surface passivating solvents for single and mixed halide perovskites, RSC ADVANCES 12 : 44 pp. 28853-28861., 2022
2. Datz D., Németh G., Rátkai L., Pekker Á., Kamarás K.: Generalized Mie Theory for Full-Wave Numerical Calculations of Scattering Near-Field Optical Microscopy with Arbitrary Geometries, PHYSICA STATUS SOLIDI - RAPID RESEARCH LETTERS Paper: 2300370, 2024