Naďa Mrkývková

CEMEA SAS

Project number
IM-2023-82

Project duration
1.7.2024-30.6.2029

"The MPULZ program provides me with the resources to dedicate my research solely to halide perovskites, supporting both financial stability and the development of a well-equipped research group. Additionally, it encourages me to compete for prestigious European projects"

BIOGRAPHY

Nada Mrkyvkova (née Tesarova) studied physics at the Charles University in Prague, where she received her Master's degree in 2008 (Master thesis: Influence of magnetic field on spin dynamics in semiconductors) and a PhD. in 2013 (Thesis: Investigation of magnetization dynamics in GaMnAs by ultrafast laser spectroscopy). During her PhD studies, she gained international experience through a six-month internship at the University at Buffalo, New York, where she studied magnetooptical effects by infrared spectroscopy. After her PhD studies, she went on a 4-year maternity leave with two children. In 2017, she joined the Institute of Physics, Slovak Academy of Science, where she focused on small organic semiconductors for photovoltaics. In 2020, she expanded her scientific interest to halide perovskites at CEMEA SAS. Her expertise has been recognized through regular beamtime allocations at leading European synchrotron facilities, including ESRF, Soleil, and DESY. She is also a national delegate for the European Synchrotron Users Organisation and the European Strategy Forum on Research Infrastructures. She published over 40 publications indexed in Scopus (h-index = 15), ORCID: 0000-0002-2619-0872.

Optimizing Perovskite Films for Highly Efficient and Stable Photovoltaics

The steadily increasing energy consumption calls for renewable technologies that could substitute environmentally detrimental and costly fossil fuels. These technologies must satisfy environmental, economic, and social feasibility criteria. Perovskite-based solar modules show the ability to meet these fundamental requirements. Recently, the power conversion efficiency (PCE) of a single-junction solar cell based on halide perovskite has reached 25.7 % , and the perovskite/silicon tandems over 33 % , greatly outperforming the silicon solar cells efficiencies. Further efficiency improvement is prevented by defects that cause non-radiative recombinations – either through trap-assisted recombination in the active layer or via carrier recombination at the perovskite/transport layer interfaces. This proposal focuses on the defects in halide perovskite and related phenomena that are critical in limiting performance in photovoltaic applications. Furthermore, it aims to develop effective passivation routes to achieve further performance advances. Its innovation potential lies in increasing the efficiency of future photovoltaic applications via addressed investigation of the non-radiative traps at the grain boundary surfaces and interfaces and their efficient passivation.

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PUBLICATIONS

1. V. Held, N. Mrkyvkova, Y. Halahovets, P. Nádaždy, K. Vegso, A. Vlk, M. Ledinský, M. Jergel, S. Bernstorff, J. Keckes, F. Schreiber, and P. Siffalovic: Evolution of Defects, Morphology, and Strain during FAMAPbI3 Perovskite Vacuum Deposition: Insights from In Situ Photoluminescence and X-r ay Scattering. ACS Applied Materials & Interfaces, 16, 35723 (2024). https://pubs.acs.org/doi/10.1021/acsami.4c04095

2. Q. Guesnay, F. Sahli, K. Artuk, D. Turkay, A. G. Kuba, N. Mrkyvkova, K. Vegso, P. Siffalovic, F. Schreiber, H. Lai, F. Fu, M. Ledinský, N. Fürst, A. Schafflützel, C. Bucher, Q. Jeangros, C. Ballif, and C. M. Wolff: Pizza Oven Processing of Organohalide Perovskites (POPOP): A Simple, Versatile and Efficient Vapor Deposition Method. Adv. Energy Materials, 14, 2303423 (2024). https://onlinelibrary.wiley.com/doi/full/10.1002/aenm.202303423

3. T. Wang, D. Zheng, K. Vegso, N. Mrkyvkova, P. Siffalovic, X. Yuan, M. G. Somekh, L. Coolen, T. Pauporte, F. Fu: Flexible array of high performance and stable formamidium-based low-n 2D halide perovskite photodetectors for optical imaging. Nano Energy, 116, 108827 (2023). https://www.sciencedirect.com/science/article/abs/pii/S221128552300664X?via%3Dihub

4. N. Tesařová (Mrkyvkova), P. Němec, E. Rozkotová, J. Zemen, T. Janda, D. Butkovičová, F. Trojánek, K. Olejník, V. Novák, P. Malý, and T. Jungwirth: Experimental observation of the optical spin-orbit torque. Nature Photonics 7, 492-498 (2013). https://www.nature.com/articles/nphoton.2013.76

5. V. Held, N. Mrkyvkova, P. Nádaždy, K. Vegso, A. Vlk, M. Ledinský, M. Jergel, A. Chumakov, S. V. Roth, F. Schreiber, and P. Siffalovic: Evolution of Structure and Optoelectronic Properties During Halide Perovskite Vapor Deposition. J. Phys. Chem. Lett. 13, 11905–11912 (2022). https://pubs.acs.org/doi/abs/10.1021/acs.jpclett.2c03422

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