ANFF-SA

Advancements in perovskite technologies set to revolutionise the solar industry

Providing micro and nano fabrication facilities for Australia's researchers, students and industry

Access to world-class microfabrication technologies has enabled a team of Monash University researchers to develop affordable, scalable, low temperature and high-performance perovskite solar cells.

Exploiting the capabilities of a microfluidic device, Dr Adam Surmiak and his research group from the Department of Chemical and Biological Engineering at Monash University, have created of one of the highest performing perovskite solar cells (PSC) in the world.

Designed and fabricated by Dr Surmiak, the microfluidic device has enabled his team to apply inexpensive techniques and simple approaches which effectively eliminate the need for the high temperature process treatments used in traditional PSC recipes.

The mixing capabilities of the microfluidic device allow the team to deposit uniform ligand-engineered cubic nickel oxide (NiO) nanoparticles, which are processed at low temperature to form the critical thin sheets of material inside a PSC, known as hole-transporting layers (HTL). These functional layers play an intrinsic role in the photovoltaic performance of a PSC, influencing its power conversion efficiency, long-term stability, and scalability.

The inspiration to integrate microfluidics into his research occurred to Dr Surmiak while attending a free, four-day Microengineering School. Run annually by the South Australian node of the Australian National Fabrication Facility (ANFF-SA) the program provides Australia's brightest engineering students with an insightful introduction to the design and fabrication of microfluidic/electronic, MEMS, optical and sensing chips with hands-on practical experiences in world-class cleanroom facilities.

"Attending Microengineering School I learned about ANFF-SA's capabilities in photolithography and microfluidic mixing and I really benefited from hands-on CAD training," said Dr Surmiak. "That's when I realised the possibility of designing and building a microfluidic mixer to suit our needs and saw the real potential that ANFF-SA offers in terms of commercialisation."

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> **Dr Adam Surmiak, Department of Chemical and Biological Engineering, Monash University.**

The program sparked a productive collaboration, initially between Dr Surmiak and ANFF-SA, resulting in improved flow simulations and the development of his mixing device to optimise the NiO nanoparticle dispersion. As word spread of his team's success, other researchers across Monash University and the CSIRO approached Dr Surmiak seeking permission to adopt his recipes and microfluidic mixers into their projects.

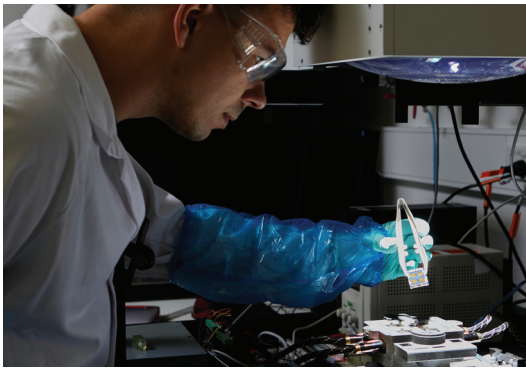
Dr Surmiak says ANFF-SA's ability to immediately catch what researchers are interested in and develop a streamlined relationship for fast delivery of the project has played an important role in his research success.

"The ANFF-SA team are open and honest professionals who have helped our team to recognize the bottle necks and our process limitations," said Dr Surmiak. "We were able to learn from ANFF-SA's experience and employ those skills to further the development of our perovskite solar cells."

Dr Surmiak says the great range of tools available through ANFF-SA will help his team with future developments, which he hopes will lead to fully printed flexible inverted PSCs, providing affordable power conversion efficiency at scale.

Co-located at Flinders University and the University of South Australia's Mawson Lakes campus, ANFF-SA is a world-class micro and nanofabrication facility providing access to cutting-edge equipment and facilities with support from expert staff. Specialising in microfluidics, organic electronics, biomaterials, novel semiconductor materials and characterisation, ANFF-SA can support or undertake the research and development of your next project.

If you would like more information on ANFF-SA or would like to participate in our next Microengineering School please contact Simon Doe on 08 8302 5226 or visit anffsa.com.



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