IET National Travel Award Report 2023

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In May 2023, I was fortunate to be selected for one of the IET National Travel Awards to attend and present my work in the 15th International Conference on Hybrid and Organic Photovoltaics (HOPV-23), held during 12th-14th June at the iconic Senate House University Library of the University of London. Organized annually by NanoGe, this is among the most prestigious scientific conferences in the field of emerging solar technologies, which also tracks the remarkable advancements of organic and hybrid solar cells in the last decade terms of efficiency, cost and processability. As such, the conference this year focused on the development, function and modeling of materials and devices for perovskite solar cells, organic solar cells, quantum dot solar cells and dye sensitized solar cells.

In this conference, I presented a poster entitled “Suppression of Ion Migration and Compositional Instabilities in Mixed Lead-Tin Halide Perovskite Materials and Devices”, which was based on my PhD research conducted at the world-leading Optoelectronics group at the Cavendish Laboratory, University of Cambridge. Despite the meteoric rise in the development of a variety of perovskite electronic and optoelectronic devices, the phenomenon of ion migration remains a common and longstanding Achilles’ heel limiting their performance and operational stability. In particular, ionic screening of the applied gate potential especially near room temperature reduces the gate modulation of carriers in the semiconducting channel of lead (Pb) perovskite field effect transistors (PeFETs), resulting in inferior carrier mobilities and non-idealities in device characteristics. Similarly, ionic movements under light and/or bias have been shown to result in current-voltage hysteresis, open circuit voltage gain and short circuit current losses in operating Pb perovskite solar cells (PSCs). In my work, I showed that alloying Pb with Sn significantly suppresses the ionic transport in both PeFETs and PSCs using a range of electrical measurements, supported by density functional theory calculations. As a consequence of this, we also demonstrated reliable hysteresis-free p-type PeTFTs with high mobility reaching 5.4 cm^2/Vs, which is one of the highest reported mobilities for 3D perovskite thin films. Moreover, due to the minimal influence of ionic migration under operation, we established FETs as a powerful platform to study the inherent physics of long-range charge transport and shallow traps for doped perovskite semiconductors.

HOPV-23 attracted more than 300 delegates, with 3 keynote speakers, 25 invited speakers, 70 contributed speakers and more than 200 poster presenters. Therefore, this was an excellent opportunity for scientists and engineers around the world to discuss the latest developments in the field and build connections. As a new postdoctoral researcher, I very much enjoyed networking with my peers during the poster sessions and tea and lunch breaks over those 3 days. My poster attracted a large number of visitors, and such interaction really helped me to get useful feedback on my work. It also helped me to project and highlight my work to the broader community, which is important to remain visible in this crowded research space. One of the most significant takeaways for me was that I was successful in initiating a

collaboration with a research group in AMOLF, Amsterdam, which is currently ongoing. I also met a number of PhD researchers from around the world and provided them with some advice regarding possible postdoctoral positions in the UK and Europe. Overall, this trip was really fruitful and enjoyable and therefore I wholeheartedly thank the IET for awarding me with a prestigious travel grant. I very much appreciate the support from IET over the last two years and I hope to continue working with them for times to come.

Photo: Krishanu Dey explaining his work to the conference attendees

Photo: Group photo taken during HOPV-23 conference