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**Bibliography: Dr. Md. Shahiduzzaman** is an Assistant Professor (Tenure Track) at the Nanomaterials Research Institute (NanoMaRi), Kanazawa University where he designs, fabricates and develops highly efficient and stable perovskite solar cells (PSCs) for next-generation solar cells. Born in Bangladesh in 1984, Dr. Shahiduzzaman moved to Japan for postgraduate study in 2011. He obtained a Master degree in Thermoelectric Materials & Application from Japan Advanced Institute Science & Technology in 2013 and did his Ph.D. on PSCs from Kanazawa University in 2016. Then, twice he did post-doctoral before joining at NanoMaRi. Then, he was an Assistant professor (Fixed Term) up to October, 2022. He published 4 patents and over 100 peer-reviewed articles until the date.

## Summary of My Presentation:

## Title: *High Stable Perovskite Solar Cells using Ionic-liquid Addition and Cesium Halides Intercalation Technology*

The rapid development of perovskite solar cells with a certified power conversion efficiency (PCE) of 25.7% is already at the level of commercialization. Still, long-term operational stability has become a major concern owing perovskite's intrinsically soft ionic crystal structures. Very recently, we used the ionic liquid (IL) aided-$CH_3NH_3PbI_3$ ($MAPbI_3$) perovskite nanoparticles (NPs) as a seeded-growth approach to fabricate high moisture-stable perovskite solar cells with a PCE of around 20%.[1] It retained above 80% of its initial output even after 6000 hours of storage at ambiance with relative humidity (RH) range of 30−40% (non-encapsulated). In the first half, we found that IL-aided $MAPbI_3$ NPs form in the grain boundary of the CsFAMA perovskite crystal domains. This implies that the embedding of IL-aided $MAPbI_3$ NPs in the CsFAMA perovskite crystal domain showed increased hydrophobicity (water contact angle of 72.3°) than pristine CsFAMA (water contact angle of 54.1°) by repelling moisture and preventing drop water infiltration under humid conditions.

In the second half, I will talk about cesium halides (CsX: CsCl, CsBr, CsI) intercalation technology for efficient and stable PSCs. Previously, we intercalated vacuum deposited cesium iodide (CsI) into solution processed host $MAPbI_3$ perovskite framework and achieved a PCE of 18.43% and remained above 80% of their initial output after 6000 h storage in open air (non-encapsulated) for the first time.[2] In this study, we introduced vacuum deposited CsX (CsCl, CsBr and CsI) thin layers into solution processed host $MAPbI_3$ perovskite film from the up, down or both layers to promote precise intercalation, resulted in high-quality perovskite film for high stable PSCs. The use of CsX layer greatly altered the $MAPbI_3$ morphology to produce large grain sizes, as a result of the precise intercalation of the CsX molecules into the host $MAPbI_3$. We tested moisture stability for 3000 h storage at ambient with a RH range of 50–60% (non-encapsulated), Cs-containing perovskite films showed higher stability (no color changed, retained black) than pristine $MAPbI_3$ film (color changed and degraded).

**References**

(1) M. Shahiduzzaman, J. M. Nunzi, T. Taima, *ACS Applied Materials & Interfaces* **2021,** 13, 21194-21206.

(2) M. Shahiduzzaman, J. M. Nunzi, T. Taima, *Nano Energy* **2021,** 86, 106135.