Factors for Manufacturing Scalable & Printable Perovskite Solar Cells

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Abstract

The power conversion efficiency (PCE) of perovskite solar cells (PSCs) has exceeded 24%. Despite such high PCEs, the development of scalable printing technique of perovskite film and the fabrication of highly efficient large-area module remains a challenge toward commercialization of PCSs. Gravure printing is a promising candidate with the benefit of direct printing of the desired layer with arbitrary shape and size by using the R2R process. To realize this, efficient planar structured perovskite solar cell must be fabricated, therefore, many factors should be considered such as charge transport and crystallization of perovskite.

In this talk, first, we will discuss the way to fabricate efficient planar structured perovskite solar cells. SnO_2 and C_{60} based ETLs were designed to study the efficient charge transport in planar structured perovskite solar cells. Bi-layered SnO_2 and cross linked C_{60} ETLs were introduced and applied to planar and flexible devices.

Finally, we will discuss one step fabrication of perovskite film via gravure printing. Printing inks and processing parameters are optimized to obtain smooth and uniform films. Low temperature SnO_2 nanoparticles are uniformly printed by reducing surface tension. Perovskite layers are successfully formed by optimizing the printing parameters and subsequent antisolvent bathing. Spiro-OMeTAD is also successfully printed. The all-gravure-printed device exhibits 17.2% champion efficiency. This study illuminates the possibility of the fabrication of high-performed printed PSCs using gravure printing which is a high throughput production technologies that enables more cost-effective industrial production.

Biography

Song has been a senior researcher in the Division of Advanced Materials at Korea Research Institute of Chemical Technology (KRICT) since 2018. He received his Ph. D degree from the Department of Chemical Engineering at POSTECH, South Korea, under the supervision of Prof. Taiho Park. His current research interests charge transport at the interface of organic-inorganic semiconducting materials and stability of high efficient perovskite solar cells.