Alkyl Ammonium Modified PEDOT: PSS enables Highly Efficient and Reproducible Roll-to-Roll Inverted Perovskite Solar Cells

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The high-power conversion efficiencies (PCEs) for perovskite solar cells (PSCs) on lab-scale devices triggers the interest towards targeting research efforts into upscaling feasibility in order to accelerate their commercialisation transition.[1,2] Up-scalability studies are critical for "lab-to-fab" transformation which requires the development of scalable fabrication protocols that enable coating uniformity over large areas and continuous production runs.[3–6] Roll-to-roll (R2R) printing on flexible substrates is considered a promising technology for high-volume and low-cost manufacturing especially for PSCs due to its solution processibility and compatibility with various R2R coating methods. Herein, we report a facile R2R hot deposition technique to fabricate triple-cation ($Cs_{0.07}FA_{0.79}MA_{0.14}Pb(I_{0.89}Br_{0.11})_3$ perovskite films at ambient environment using slot-die coating method **(Figure 1)**.[7] We demonstrate slot-die coated flexible perovskite solar cells (f-PSCs) with reproducible PCE of 12% on an active area of 0.2 cm^2 in inverted 'p-i-n' architectures, which is the highest efficiency reported to date for R2R inverted PSCs with stable mixed cation composition. To achieve this, we modified the hole transport layer (PEDOT: PSS) with guanidium iodide (GAI) additive which results in reducing the photo-voltage losses and improving the fill factor, thereby upgrading the overall device performance. We report comprehensive characterisation of hot-deposited perovskite films and the devices incorporating them. This study highlights the potential of the facile hot-deposition method while providing critical insights into the role of interfacial engineering in eliminating performance losses and fabricating commercially efficient printed f-PSCs.

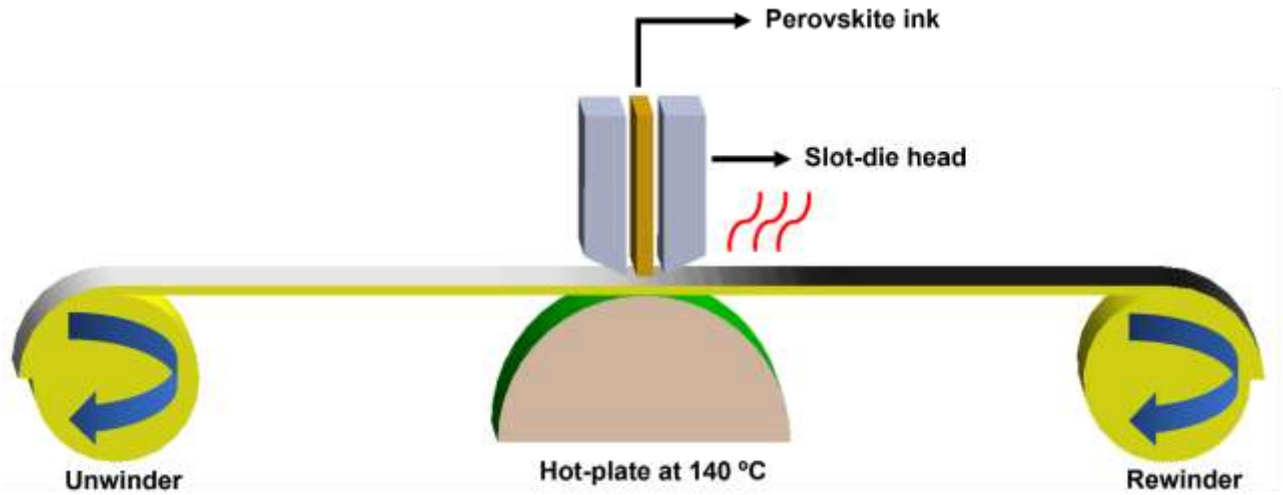

Figure 1. Schematic of the employed hot deposition technique for perovskite films fabrication.

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