Solution Processed Electronic Materials for Next Generation Photovoltaics

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Light is one of the most valuable goods on earth: The sun is the single most clean and sustainable energy source which can solve all the energy needs of our world. The energy in the sunlight striking the earth for 40 min is equivalent to the global energy consumption for a year. Over the last decade solution processed organic and hybrid perovskite solar cells have been amongst the most prominent next generation photovoltaic (PV) technologies, reaching power conversion efficiencies (PCEs) of over 18 % and 24 % respectively [1,2].

However, both PV Technologies are facing product development issues, such as the need to achieve long-term stability and the development of carrier selective contacts for the reliable processing of high-performance devices. Their overriding attraction of both technologies is the potentially low production cost of the PV module, arising from the large-scale PV film production through printing techniques. The Presentation aims in covering a range of engineering and underpinning scientific issues needed to bring organic and hybrid perovskite PVs to commercial viability in terms of efficiency, lifetime and cost. A systematic understanding of the relationship between printed electronic materials [3], processing and solar cell performance relevant to next generation organic and hybrid perovskite PVs product development targets will be presented [4,5].

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[1] N Bao, S.; Yang, H.; Fan, H.; Zhang, J.; Wei, Z.; Cui, C.; Li, Y. Volatilizable Solid Additive-Assisted Treatment Enables Organic Solar Cells with Efficiency over 18.8% and Fill Factor Exceeding 80%. Adv. Mater. 33 (48), 1–10, 2021.
[2] Jeong, M.; Choi, I.W.; Go, E.M.; Cho, Y.; Kim, M.; Lee, B.; Jeong, S.; Jo, Y.; Choi, H.W.; Lee, J.; et al. Stable perovskite solar cells with efficiency exceeding 24.8% and 0.3-V voltage loss. Science 369, 1615LP–1620LP, 2020.
[3] S. Pozov, I. Theodorakos, K. Andritsos, E. Georgiou, A. Ioakeimidis, A. Kabla, I. Zergioti, S.A. Choulis, Highly Efficient Indium Tin Oxide-Free Inverted Organic Photovoltaics using Laser Induced Forward Transfer Silver Nanoparticle Embedded Metal Grids, submitted to ACS Applied Electronic Materials, 2022.
[4] Long Thermal Stability of Inverted Perovskite Photovoltaics Incorporating Fullerene-Based Diffusion Blocking Layer, F. Galatopoulos, I. T Papadas, G. S. Armatas, S. A Choulis, 5, 1800280, 2018.
[5] Apostolos Ioakeimidis, Alina Hauser, Michael Rossie, Flavio Linardi, and Stelios A. Choulis, High Performance Non-Fullerene Acceptor Inverted Organic Photovoltaics Incorporating Solution Processed Doped Metal Oxide Hole Selective Contact, submitted to Applied Physics Letters, 2022.