

## THE ADVENT OF MESOSCOPIC SOLAR CELLS

GRÄTZEL Michael

*Swiss Federal Institute of Technology in Lausanne, Lausanne, Switzerland*

### Abstract

Solar cells using dyes or semiconducting pigment particles as light harvesters supported by mesoscopic oxide films have emerged as credible contenders to conventional p-n junction photovoltaics [1]. Separating light absorption from charge carrier transport, dye sensitized mesoscopic solar cells (DSSCs) were the first to use a three-dimensional nanocrystalline junction for solar electricity production. Molecularly engineered donor-acceptor porphyrine dyes reach currently a power conversion efficiency (PCE) of up to 13 percent [2,3] under standard air mass 1.5 (AM1.5) reporting conditions (25°C, 1000 Watt/m<sup>2</sup> solar intensity) Recently another breakthrough was witnessed with the meteoric rise of metal halide perovskites as powerful light harvesters for thin film photovoltaics [4]. Solid state mesoscopic cells based on CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> pigments supported by a nanocrystalline TiO<sub>2</sub> scaffold and organic or inorganic hole conductors have now reached a certified power conversion efficiency of 17.9 % and further rapid improvements in performance appear to be feasible. Carrier diffusion lengths extending over 100 nm have been measured [5] even from solution processed perovskite solar cells (PSCs) and very stable embodiments based on carbon current collectors have recently been realized.

### LITERATURE

- [1] M. Grätzel **Nature** 414, 338 (2001).
- [2] A. Yella, H.-W. Lee, H. N. Tsao, C. Yi, A. Kumar Chandiran, Md.K. Nazeeruddin, EW-G Diau, C.-Y. Yeh, S. M. Zakeeruddin and M. Grätzel **Science** 629, 334 (2011).
- [3] S. Mathew, A. Yella, P. Gao, R. Humphry-Baker, B.F.E. Curchod, N. Ashari-Astani, I. Tavernelli, U. Rothlisberger, Md.K. Nazeeruddin, M. Grätzel. **Nature Chemistry** S. Mathew, A. Yella, P. Gao, R. Humphry-Baker, B.F.E. Curchod, N. Ashari-Astani, I. Tavernelli, U. Rothlisberger, Md.K. Nazeeruddin, M. Grätzel **Nature Chemistry**, 6, 242-247 (2014)
- [4] J. Burschka, N. Pellet, S.-J. Moon, R. Humphry-Baker, P. Gao, M. K. Nazeeruddin and M. Grätzel, **Nature** 499, 316-319 (2013).
- [5] G.C Xing, N. Mathews, S.Y. Sun, S.S. Lim, Y.M., Lam, M Grätzel., N., S. Mhaisalkar and T.C.. Sun **Science** 342, 344\_347 (2013). S.,

**Author did not supply full text of the paper/poster.**