All-Small-Molecule Organic Solar Cells – Performance, Electronic & Microstructure Properties

Pascal Kaienburg [a], Moritz Riede [a]
[a] *Clarendon Laboratory, Department of Physics, University of Oxford, UK, University of Oxford, Parks Rd, Oxford, United Kingdom*

Materials for Sustainable Development Conference (MATSUS) (/Materials-for-Sustainable-Development-Conference)
Proceedings of Materials for Sustainable Development Conference (MAT-SUS) (NFM22)
#BRIGHT - Recent Breakthroughs in Organic Photovoltaics
Barcelona, Spain, 2022 October 24th - 28th
Organizers: Thomas Anthopoulos and Safa Shoaee

Invited Speaker, Pascal Kaienburg, presentation 360
DOI: https://doi.org/10.29363/nanoge.nfm.2022.360 (https://doi.org/10.29363/nanoge.nfm.2022.360)
Publication date: 11th July 2022

Organic solar cells (OSCs) based exclusively on small molecules have distinct advantages over polymer-based OSCs for commercial applications. Unlike polymers, small molecules have a defined molecular weight and can be purified easily, resulting in a simpler, more reproducible synthesis with controlled quality. Solution-processed All-small-molecule (ASM) OSCs have reached 17% power conversion efficiency, and ASM-OSCs fabricated via vacuum thermal evaporation (VTE) are leading OSC commercialization. However, ASM-OSCs remain less investigated than polymer-based OSCs in terms of their semiconducting and microstructure properties.

Here, we perform extensive optoelectronic characterization on high-performing ASM-OSC deposited from solution and in vacuum to quantify absorption, voltage losses and charge transport – probed via ellipsometry, sensitive EQE and CELIV, respectively. Example systems include VTE DCV5T-Me:C60, and solution-processed BTR-Cl:Y6. We find that certain VTE ASM-OSC achieve strong absorption, decent charge carrier mobility, or voltage losses matching corresponding polymer-based OSCs but no VTE blend combines all these favourable properties. We further investigate the blend microstructure in terms of phase separation. Interdiffusion experiments offer a thermodynamic perspective while the actual phase separation in probed via soft X-rays. This talk gives an overview over prospects and challenges of All-Small-Molecule organic solar cells and provides an outlook on open research questions.

---

nanoGe (/)

nanoGe is a prestigious brand of successful science conferences that are developed along the year in different areas of the world since 2009. Our worldwide conferences cover cutting-edge materials topics like perovskite solar cells, photovoltaics, optoelectronics, solar fuel conversion, surface science, catalysis and two-dimensional materials, among many others.

(/Materials-for-Sustainable-Development-Conference)**MATSUS (/Materials-for-Sustainable-Development-Conference)**