Department of Physics
Condensed Matter Physics
Clarendon Laboratory, Parks Road, Oxford OX1 3PU

UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Thursday 17 January at 2.15pm

"Quantifying loss-mechanisms related to charge carrier collection in thin-film solar cells"

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Processes taking place at contacts are of particular importance in organic and perovskite solar cells where selective contacts that are able to efficiently collect majority carriers, simultaneously blocking minority carriers are desired. However, a comprehensive understanding of the processes taking place at the contacts in organic thin-film semiconductor devices is still lacking.

In the talk I will highlight our efforts in clarifying loss-mechanisms related to charge carrier extraction in thin-film devices using drift-diffusion simulations. The surface recombination velocity S_R, describing the quality of the contact interface, is a key parameter in obtaining an increased understanding of the kinetics taking place at contacts in thin-film devices [1].

We have also extended the analytical framework of the charge extraction by linearly increasing voltage (CELIV) theory taking the effect of built-in voltage, diffusion and band-bending into account and show how we can experimentally quantify loss mechanisms in charge collection [2-3]. We have derived analytical expressions describing the effective reduction of the built-in voltage and the (effective) open-circuit voltage providing means to quantify and distinguish various (loss) mechanisms for contact related effects in thin film solar cells. We have used the technique to experimentally measure surface recombination velocities at collecting contacts in interface-limited organic semiconductor devices [4].

References

[1] O. Sandberg, M. Nyman, R. Österbacka, Physical Review Applied 1, 024003 (2014)
[2] O. Sandberg, M. Nyman, R. Österbacka, Organic Electronics 15, 3413-3420 (2015)
[3] S. Dahlström, O.J. Sandberg, M. Nyman, and R. Österbacka, Physical Review Applied 10, 0554019 (2018).
[4] O.J. Sandberg, et. al, Physical Review Letters, 118, 076601 (2017).

Host: Dr Moritz Riede

Audrey Wood Seminar Room, Clarendon Laboratory