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Studying the dynamics of PTB7:PCBM organic photovoltaic active layers

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In organic photovoltaics, donor - acceptor bulk heterojunctions are often used as active materials due to their superior performance compared to e.g. planar layered devices. In this optically active polymer layer, a photon is absorbed and an exciton created. After diffusion to a donor-acceptor interface, the exciton is dissipated and charge carriers can be extracted at the electrodes [1].

A frequently applied and well-studied system is the combination of P3HT ($(C_{10}H_{14}S)_n$) as electron donor and PCBM ($C_{72}H_{14}O_2$) as electron acceptor. Previous studies have shown, that internal dynamics and structural layout of the active layer influence its electronic properties and thus its performance in a device [2], [3]. A novel, very promising electron donor material is PTB7 ($(C_{41}H_{53}FO_4S_4)_n$). We produced films of PTB7, PCBM and a mixture of these two from a chlorobenzene solution and performed first quasielastic neutron scattering (QENS) experiments on this system in order to evaluate the dynamics of pure compounds as well as blend films on a pico- to nanosecond timescale and potential influences of manufacturing parameters (e.g. mixing ratio, solvent choice, annealing time/temperature). QENS experiments were performed at the MLZ - instrument TOFTOF in a temperature range between 150 K and 400 K.

[1] H. Wang et al. (2014), *Materials*, 7, 2411–2439

[2] A. Guilbert et al. (2016), *The Journal of Physical Chemistry Letters*, 7, 2252–2257

[3] T. Etampawala et al. (2015), *Polymer*, 61, 155–162

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