Using *in-situ* time-resolved Vis-NIR spectro-electrochemistry to study kinetics in IDTBT polymers

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Organic bioelectronics deals with the study of organic electronic devices which are working at the interface of biology and electronics, encompassing wearable to implantable devices, which e.g., can work as sensitive biomedical sensors. Organic semiconducting materials combine advantageous properties such as their soft and flexible nature, versatile processing and synthetic tunability making it possible to span such a high range of applications.[1] In the recent years, much focus was so far on electrical characterization of the devices, in order to improve fabrication methods and to find better material options. Hence there is still a need for a more in-depth understanding on the fundamental effects happening during the functioning of bioelectronic devices.[2] A semiconducting material which recently sparked large interest due to its outstanding charge carrier mobility of up to 1 $cm^2V^{-1}s^{-1}$ in organic field effect transistors (OFET) is IDTBT, a donor-acceptor copolymer with a planar and near-torsion-free backbone allowing for such high mobility.[3] Four IDTBT polymer with different amount of alkyl versus glycol side chains were chosen here to control the conformation, local morphology and ion-affinity of IDTBT. We used *in-situ* time-resolved Vis-NIR spectro-electrochemistry and Multivariate Curve Resolution (MCR) analysis to assign different bands in the absorption spectrum to the different kins of species present during the doping process (neutral segments, polarons, bipolarons). Furthermore, the evolution of the species as a function of time could be determined and an overview of IDTBT redox kinetics was established.

[1] J. Rivnay, R. M. Owens, G. G. Malliaras, *Chem. Mater.*, 2014, **26**, 679-685.

[2] J. Chung, A. Khot, B. M. Savoie and B. W. Boudouris, *ACS Macro Letters*, 2020, **9** (5), 646-655.

[3] X. Zhang, H. Bronstein, A. J. Kronemeijer, J. Smith, Y. Kim, R. J. Kline, L. J. Richter, T. D. Anthopoulos, H. Sirringhaus, K. Song, M. Heeney, W. Zhang, I. McCulloch, D. M. DeLongchamp, *Nat. Commun.*, 2013, **4**, 2238.