Hybrid Inorganic/Organic Systems for Opto-Electronics

Collaborative Research Centre 951

Colloquium Announcement

of the Collaborative Research Centre 951
"Hybrid Inorganic/Organic Systems for Opto-Electronics"

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Conductivity and charge transfer dynamics in electrochemically doped P3HT

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(i) The Schottky–Mott Rule Expanded for Two-Dimensional Semiconductors, and (ii) Photoexcitation-induced energy level realignment at semiconductor heterojunctions

Time: Thursday, 23.06.2022, 15:15

Place: **IRIS Adlershof, Zum Großen Windkanal 2 Room 2'049 (Foyer)**

Meeting-ID: 615 2251 9123
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Conductivity and charge transfer dynamics in electrochemically doped P3HT

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Doping of organic semiconductor films enhances their conductivity for applications in organic electronics, thermoelectrics and bioelectronics. However, much remains to be learnt about the properties of the conductive charges in order to optimize the design of the materials. Electrochemical doping is not only the fundamental mechanism in organic electrochemical transistors (OECTs), used in biomedical sensors, but it also represents an ideal playground for fundamental studies. Benefits of investigating doping mechanisms via electrochemistry include controllable doping levels, reversibility and high achievable carrier densities. We introduced here a new technique, applying in-situ terahertz (THz) spectroscopy directly to an electrochemically doped polymer in combination with time-resolved spectro-electrochemistry and chronoamperometry. We evaluate the intrinsic short-range transport properties of the polymer (without the effects of long-range disorder, grain boundaries and contacts), while precisely tuning the doping level via the applied oxidation voltage. We find that polarons and bipolarons need to co-exist in an optimal ratio to reach high THz conductivity for in aqueous KPF6 electrolyte. Moreover, the analysis of the spectro-electrochemistry data shows that those two species are generated at different rates in amorphous and crystalline regions of the film. Overall, the study allows a precise understanding of the electrochemical doping mechanism of the most common semi-crystalline conjugated polymer P3HT.