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Understanding the dependence of charge transport on morphology in organic semiconductor films

Initiative: Trilaterale Partnerschaften – Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der

Ukraine, Russland und Deutschland

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The project addresses the issue how and by which mechanism the morphology affects charge-carrier mobility in a concerted experimental and theoretical effort. It is planned to determine by which processes the film structure controls the morphology and how the morphology influences charge-carrier transport. The aim is thus to develop a comprehensive model for the complex morphology-mobility relationship that can quantitatively account for the various experimental observations. To this end, it is intended to (i) use a range of processing techniques to prepare organic thin films with different morphologies, (ii) employ optical and structural investigations to determine the film structure, (iii) measure mobilities and the energy distribution of localized states and traps for charge-carriers (iv) calculate the effect of structural variations on charge-carrier transport at various time and length scales from atomistic to device by a set of complementary theoretical approaches, both established and newly developed within the project. Altogether, it is envisaged to obtain not only a unified understanding of charge transport in semiconductors with different degrees of structural order, but it is expected to also obtain general rules for the design of organic materials with high charge carrier mobility, including practical recommendations for film processing. This will assist the development of viable technologies for production of organic electronic devices such as OFETs, OLEDs, OSCs.

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