Template-Designed Organic Electronics

We report the unique and novel approach of achieving a polycrystalline thin film consisting of uniaxially aligned domains by using 7-armchair graphene nanoribbon (7-aGNR) monolayers as van- der-Waals template. For this purpose, different merocyanine dyes were evaporated on 7-aGNRs, transferred on quartz glass substrates. The alignment of the formed molecular aggregate along the GNR alignment direction was proven by polarisation dependent absorbance spectroscopy, revealing an anisotropy of ca. 1 order of magnitude. The J- and H-transition, formed by the HB238 aggregate, were correlated with distinct axes of the crystal structure. By combining this correlation with polarisation dependent absorbance measurements and X-ray diffraction experiments we elucidated the three-dimensional structure of the formed aggregate thin film.
The growth mode of these films was investigated as a function of the deposited layer thickness. Atomic force microscopy-based morphology analysis and X-ray diffraction experiments were used to reveal the anisotropic on-surface crystallisation along the 7-aGNR long axes direction. Furthermore, we found that the delocalisation length of the aggregate increases with increasing in- plane order. Both effects can be correlated with the critical dimensions of the formed crystal grains. Finally, we demonstrated that the in-plane alignment leads to an anisotropic charge carrier transport by implementing the templated merocyanine thin film as active layer in a top-gated organic field effect transistor.

Prof. Dr. Klaus Meerholz
Institute of Physical-Chemistry
Department of Chemistry
University of Cologne (Germany)

Tuesday, May 9th, 2023

16:00

Aula II

Via Selmi 2, 40126 – Bologna