

## **Structural investigation of thin polymer nanocomposite and blend films for photovoltaic applications**

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Photovoltaic energy conversion systems based on inorganic-organic materials, so called hybrid solar cells, as well as purely organic materials are promising candidates to be competitive to conventional silicon photovoltaic systems.

The research on novel approaches for photovoltaic material systems in our group is combining three linked areas: 1) nanostructured TiO<sub>2</sub> thin films from self-encapsulating inorganic-organic hybrid materials, 2) TiO<sub>2</sub>:semi-conducting polymer thin hybrid films and 3) structuring of photo-active polymer and polymer blend thin films.

The research is focused on the structural characterization of the thin films in different stages of preparation towards a device. It combines real space imaging techniques with advanced scattering techniques. The scattering experiments are performed with x-rays at synchrotron radiation sources, with neutrons and with light. As a consequence, a large range of length scales from the molecular level to microscopic and macroscopic structures are addressed.

With optical methods and atomic force microscopy (AFM) the surface structure is probed. Scattering allows in addition to access the structure inside the photo active films. X-ray reflectometry (XRR) and neutron reflectometry (NRR) yield the density profile along the surface normal and grazing incidence small angle x-ray scattering (GISAXS) and grazing incidence small angle neutron scattering (GISANS) give access to lateral structures. These methods are non-destructive and provide averaged information over macroscopic regions, whereas morphological information on nanometer scale is extracted.

The photo physical characterization complements the investigations on the structural morphologies.