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Spray cast organic solar cells

Besides having a research focus on preparation methods, deposition techniques play an important role in producing solar cells as well. In particular, next generation solar cells are typically based on a wet chemical approach and therefore enable completely new pathways of device manufacturing. Compared to laboratory-based routines such as spin coating, large-scale coating processes such as spray coating and printing are of particular interest due to their potential for having an adaptability to industrial processes. In particular, spray coating is a very cost-effective method that provides the possibility for a rapid and large-scale film deposition on complex-shaped surfaces. However, spray coating as a rapid solution-based preparation route usually features complex evolutions of the film structure and morphology. For a better understanding of the complex behavior of the involved kinetic processes, in situ morphology investigations are highly desirable but as well imply a great experimental challenge. The necessary characterization requires a continuous detection of the inner film morphology without interrupting the spray coating process or destroying the deposited films. Moreover, the in situ measurements need to be compatible with the experimental environment of spray coating under ambient conditions. Grazing-incidence wide-angle x-ray scattering (GIWAXS) measurements perfectly match the requirements of an in situ morphology characterization. This advanced scattering technique allows probing the inner film morphology in the nano- and mesoscale while sampling over macroscopic sample areas, which yields very high experimental statistics. In this project tailored polymer nanostructures based on spray coating were prepared. The GIWAXS experiment enabled to follow the structure evolution and to probe the morphology with a high statistical relevance.Moreover, active layers of different mixtures of conjugated polymers forming organic bulk hetero-junctions were prepared to investigate the influence of different mixtures on the film‘s morphology and photophysical properties.

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