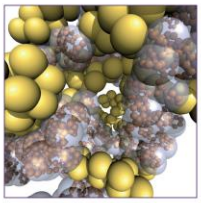

Physical Aspects of Polymer Science
8–10 September 2015
Manchester Institute of Biotechnology
Manchester, UK
http://paps15.iopconfs.org

Poster abstract

P.20 SVA induced ordering of nanoparticle-loaded diblock copolymer thin films: A GISAXS study

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Thin-film photovoltaic cells are an attractive area of research due to their flexibility and low cost, hence methods of creating new thin-film photovoltaics as alternatives for traditional energy sources are highly desirable. The efficiencies of thin film cells have been steadily increasing, in particular CIGS (Copper-Indium/Gallium-Sulphide) photovoltaics. Our project aims to create aligned arrays of spherical and rod-like nanoparticles (NPs) within the copolymer microphase structure of Poly(Styrene-block-methyl methacrylate) (PS-b-PMMA). Controlling NP orientation has applications for heterojunction photovoltaic devices, where photovoltaic nanorods aligned perpendicular to the surface act as conducting paths to the electrode, increasing the device's power conversion efficiency.

The morphology of CIGS doped PS-b-PMMA thin films undergoing solvent vapour annealing (SVA) was investigated utilising grazing incidence small angle x-ray scattering (GISAXS) and atomic force microscopy (AFM). The in-situ GISAXS experiment was conducted at the P03 microfocus beamline at Petra III. In order to study a selection of microphase structures, different SVA solvents were used according to their ability to solvatise either block of the copolymer: acetone being PMMA selective, ethyl acetate being PS selective and tetrahydrofuran being non-selective. The sample was scanned initially with no solvent to obtain the pre-SVA morphology. After several scans one of the solvents was injected into the SVA chamber to collect in-situ annealing information. The samples were then studied by AFM to obtain the surface topological information for each sample, complementing the GISAXS data analysis.

While in its early stages, the data analysis shows a lateral structure factor with ordering perpendicular to the substrate influenced by the NP loading and solvent interaction. A complementary grazing incidence small angle neutron scattering experiment has been awarded to conduct a repeat of the experiment ex-situ with deuterated samples to provide contrast. Additionally an ex-situ small angle scattering transmission geometry experiment has been awarded to again study the morphology of the films.