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Chain alignment and charge transport anisotropy in blade-coated N2200/PS blend films

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Semiconducting polymers offer the potential of low-cost flexible electronics. To improve the processability and mechanical flexibility of semiconducting polymers, blending with commodity polymers is an attractive strategy. Understanding how blending affects the resulting microstructure in aligned samples produced by directional coating techniques such as blade coating is important to optimize device performance. This presentation will discuss the microstructure of blade-coated blends of the semiconducting polymer N2200 with polystyrene (PS) using a range of techniques. In particular, we have investigated the degree of alignment of chains of the semiconducting polymer N2200 at the surface and in the bulk. UV-vis spectroscopy and surface-sensitive NEXAFS spectroscopy show that blade coating induces the preferential orientation of N2200 chains parallel to the coating direction. Angle-dependent NEXAFS enables the averaged tilt angle of the planar backbone of N2200 to be determined, revealing improved edge-on configuration at the surface with reduced N2200 content. By deconvoluting the spectra of N2200/PS blend film, the concentration of N2200 at the surface was determined, showing its tendency of segregating at the surface. Another synchrotron-based technique, grazing-incidence wide-angle X-ray scattering (GIWAXS) was used to selectively probe the crystalline phase of N2200. The GIWAXS results confirm the directional alignment of N2200 crystallites with backbone stacking direction to be parallel to the coating direction. From the analysis of crystallite orientation (texture), a transition from preferential face-on orientation to edge-on orientation at low N2200 content was seen. Finally, charge transport anisotropy was investigated by measuring organic field-effect transistors based on blade-coated N2200/PS blend films with conductive channel length parallel or perpendicular to the coating direction.

Level of Expertise

Student

Presenter Gender

Woman

Pronouns

She/Her

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

Yes

Condition of submission

Yes

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