# Charge transport anisotropy in conjugated polymer thin films

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While there appears to be no a priori reason to expect anisotropy in amorphous polymers, the value of mobility as measured horizontally in the thin film transistor (TFT) geometry has been found to be up to 4 orders of magnitude greater than that measured vertically in a diode configuration in numerous experiments over the last few decades. In this paper we investigate three thin films of MEH-PPV measuring mobility perpendicular and parallel to the substrate making use of small angle x-ray reflection (XRR) and GI-WAXS to probe the internal structure of these films. Charge transport anisotropy was greater for films spin-cast from chlorobenzene than for those from toluene while very little anisotropy was seen in drop cast films. GI-WAXS data indicated the existence of short range chain packing parallel to the substrate in spin-cast films (absent in drop cast films) while XRR data indicated that in films spin cast from chlorobenzene had an additional ~5nm thick high electron density layer along the film-substrate interface. These results indicate that anisotropy in measured mobility are not predominately due to traps, differences in electric field, interfacial effects or charge carrier density effects as has previously been proposed but rather due primarily to an optically invisible short range anistropic chain packing structure in spin coated films, with additional contribution coming from the interfacial layer. This spin processed induced local short range packing inhibits charge transport perpendicular to the structure while enhancing charge transport parallel to the structure. This suggests that in diode like devices such as photovoltaics, mobility might be enhanced by a few orders of magnitude through changes in device geometry