XMaS the UK-CRG	**Experiment title:** Grazing-incidence x-ray diffraction experiments of aligned and doped polyfluorene films	**Experiment number:** 28-01-719
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Report:

We performed GIXD and x-ray reflectivity experiment of doped and pure poly[9,9-bis(ethylhexyl)-fluorene-2,7-diyl] (PF2/6) films. This field and the characteristics of those films have been summarized in a recent review [1]. The overall situation is illustrated in Fig. 1.

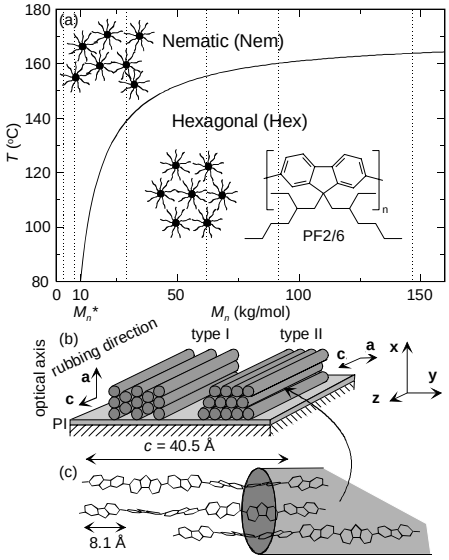

Fig. 1. (a) The phase diagram and head-view schematics of Nem and Hex phases of PF2/6 as a function of M_n. M_n*=10^4 g/mol. LMW: M_n<M_n*. HMW: M_n>M_n*. The dotted lines represent the molar weights used in this article. The schematics of (b) the crystallite types and (c) molecular structure in aligned HMW films. Adapted from Ref.[2].

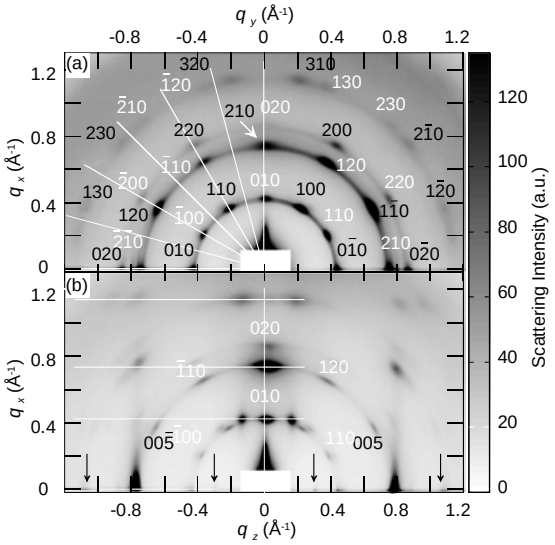

Fig. 2. The 2D GIXD patterns of the doped 29/68-PF2/6. (a) (*xy*0) plane. (b) (*x*0*z*) plane. Black and white indices correspond to the types I and II, respectively. Crystallite type III is seen as diffraction arcs. The reflections which occur very close to 002 and 007 are shown by arrows. Adapted from Ref. [3].

The objectives of our proposal were as follows: " We expect to characterize successfully well-ordered and orientated structures in thin films of important PF based materials. We will concentrate our efforts in elucidating the in-plane structure of the films where GIXD studies will allow quantification of several interesting structural parameters describing the ordered structures in the terms of orientation and paracrystallinity. We aim to quantify the effect of the strain caused by the substrate. We aim to connect these results to the observed variations in the photonic and electronic properties of the doped samples. We will be able to address directly the nature of the structural changes and explore the associated photo-physical effects on doping with derivates of PF. "

The experiment was successful, doped films were characterized, and a manuscript is in preparation[3]. In particular we have noticed the existence of 3 crystallite types (Fig. 2) and characterized their orientation dependence using phi scan at the XMaS. The essential result is that even though the orientation of crystallites is equatorially different, the meridional orientation distribution of rodlike polymers is the same *within* each crystallite types. We finally note that although we performed an individual experiment, this work is a part of our continuous program in the studies of conjugated polymer films.

[1] M. Knaapila, R. Stepanyan, B. P. Lyons, M. Torkkeli, and A. P. Monkman, *Towards General Guidelines for Aligned, Nanoscale Assemblies of Hairy-Rod Polyfluorene,* **Adv. Funct. Mater.** (2006) Published online on the 31st of January.

[2] M. Knaapila, B. P. Lyons, T. P. A. Hase, C. Pearson, M. C. Petty, L. Bouchenoire, P. Thompson, R. Serimaa, M. Torkkeli, and A. P. Monkman, *The Influence of the Molecular Weight on the Surface Morphology of Branched Side Chain Polyfluorene,* **Adv. Funct. Mater.** (2005) 15 1517.

[3] M. Knaapila, T. P. A. Hase, L. Bouchenoire et al. To be submitted to **Adv. Funct. Mater.**