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Substrate Induced Polymorphism in Organic Thin Films

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The presence of substrate induced polymorphic phases in thin films is an intriguing phenomenon with the physical and chemical factors responsible for its formation are not yet clearly understood. In particular, this is really crucial in the field of organic electronics, where the charge-transport properties are highly dependent on crystal packing, especially for organic field-effect transistors where charge transport occurs at the interface between the organic semiconductor and the dielectric. In pharmaceutical sector, thin film drug delivery is the new emerging alternative to traditional tablets and oral suspensions. The need to identify and control polymorphism induced by the substrate is thus very crucial. In this presentation, we report the structure and morphological changes associated with a substrate induced polymorphic phases in a discotic liquid crystal and a rod shaped DPP-thiophene-based molecule [1, 2]. The bulk compound and the thin films are characterized by a combination of various X-ray diffraction methods to investigate the structural properties. Atomic force microscopy and polarized optical microscopy are used to determine the thin film morphologies. This is the first experimental proof of presence of a substrate induced phase in discotic liquid crystal showcasing an unique example where the 2-D liquid crystalline phase converts to a 3-D crystal plastic phase due to nucleation caused by the solid substrate over a time scale of a month or longer. The presentation also highlights the importance of polymorphism in DPP-thiophene-based material and the specific organization that could arise from the interaction with the substrate depending on the growing conditions. Here the exact structural and the spectroscopic signatures of different polymorphic forms in bulk and in thin films could be identified. These are clearly factors to consider to induce the formation of a particular polymorph and to help to design deposition methodologies.

[1] *B.Chattopadhyay, C. Ruzié, R. Resel, Y. H. Geerts, L. Crystals, in press, DOI:10.1080/02678292.2013.809799,* ***[2]*** *S. T. Salammal, J-Y. Balandier, J-B. Arlin, Y. Olivier, et al., The Journal of Physical Chemistry C, 2014, 118, 657-669*

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