ESRF	**Experiment title:** **Self-organised nano-wires of discotic polymer-complexes on solid surfaces**	**Experiment number**: SC 717
Beamline: ID 1	**Date of experiment**: from: 06. 2. 01 to: 13. 02. 01	**Date of report**: 11. 04. 01
Shifts: 18	**Local contact(s)**: **H. Metzger, A. Mazuelas**	*Received at ESRF:*

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Report:

Soluble derivatives of Hexa-*peri*-hexabenzocoronene (HBC) are used as a model system for supramolecular structures with liquid crystalline properties. The liquid crystalline phase transition properties of these preferentially columnar structures are strongly influenced by the planar symmetry of the molecule and the subsequent ?-?-interaction between each other. Comparing various discotic columnar liquid crystals Hexakis-tetradecyl-hexa-*peri*-hexabenzocoronene exhibits the highest amount of intra-columnar charge carrier mobility (? $?_{1D}$ = 1,13 m^2 $V^{-1}s^{-1}$) ever investigated up to now. Considering the high electrical anisotropy of conductivity and the good thermal and chemical stability the molecule is a promising candidate for an application as molecular wires. Similar to coaxial wires these molecular wires consist of a conductive core of about 1 nm in diameter embedded by a cover of isolating alicylic chains.

Current investigations are focused on the problems under which condition the wires are formed and how the wires can be organised on solid support. For monolayers recent AFM inspections revealed isolated nano-wires. During our beamtime at ID1 we have studied the quality of the self-organisation process at multilayers prepared by means of the Langmuir-Blodgett technique. Mono- and multilayers of HBC and a complex built by Poly(ethylene oxide)-b-poly(L-lysine) and HBC (PEO-PLL-HBC) were covered on silicon substrate covered with (poly(ethylene)-imine –PEI) (see fig.1). Previous home x-ray inspections were not successful due to the low electron density contrast between the organic moieties. Due to the high intensity available and the good angular resolution at ID1 we could measure the x-ray specular reflectivity of several samples up to q_z= 7 nm^{-1} , i.e. over more than seven orders of magnitude. The specular reflectivity exhibits Bragg peaks and sharp Kiessig oscillations as well, which demonstrates a good vertical correlation for the complete transfer of the organic layers (see fig.2). Although radiation damages could not be avoided completely we could record a (q_x ,q_z) area map (fig. 3). As shown in fig.4 the q_x-scans exhibit nearly flat off-specular scattering but sharp oscillations since the incidence – or exit angle, respectively, become close to the critical angle of total external reflection. Both can be explained by a small lateral correlation length but vertical correlation near the sample surface. The evaluation of data is not finished yet, however, first data inspection did not give a hint of the appearance of nano-wires so far. Nevertheless, the results are promising to be continued.

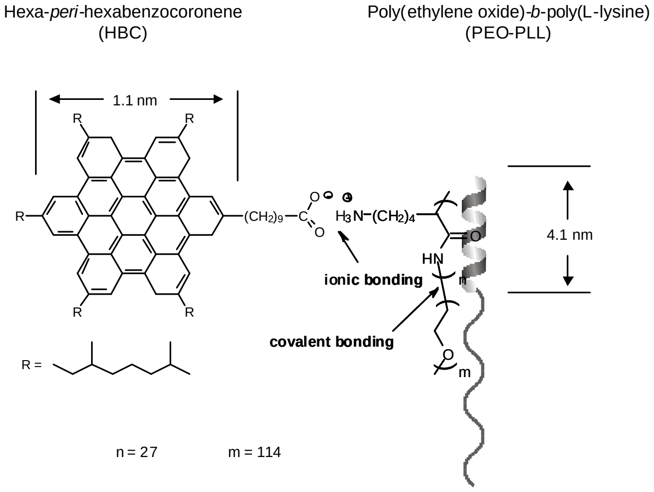

Fig. 1: Sketch of the chemical structure of HBC and the PEI complex PEO-PLL-HBC

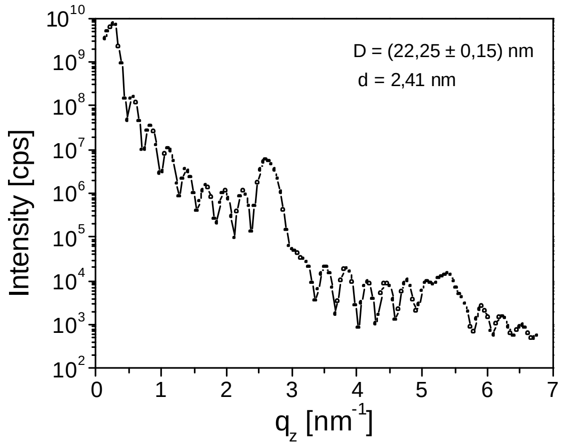

Fig. 2: Specular reflectivity of a sample with 9 ML of HBC on covered silicon

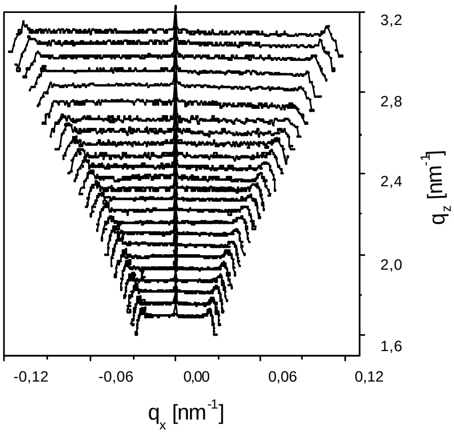

Fig. 3: Area map of HBC on PEI covered Silicon Substrate (9 monolayers)

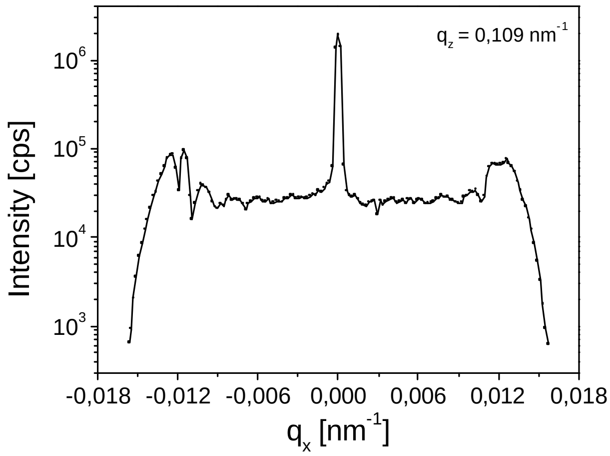

Fig. 4: selected transversal-scan from fig.3 9 ML of HBC on PEI covered silicon