Discotic liquid crystal, formed by molecules with extended aromatic cores, self-organize into molecular wires along which charge transport is possible via π-π interaction between adjacent molecular cores. A great advantage of these systems is that defects can be easily annealed by temperature treatments, which is very attractive in electronic applications.

We have realized molecular wires having lengths up to several hundreds of micrometers, spontaneously aligned along a common direction. Several factors can contribute to their self-organization, such as solvent type, surface properties of substrates and evaporation conditions. In particular, the solvent molecular structure seems to play an important role in the structural formation of the wires influencing the final morphology.

We used spin- and dip-coating deposition methods for the realization of molecular wire arrays or to obtain isolated fibers. Their morphology was investigated by atomic force microscopy (AFM) as well as polarized and standard optical microscopy. Local changes in the organization induced by temperature could be also followed by AFM. Polarized Raman spectroscopy showed a highly anisotropic response, indicating planar alignment and also reflecting the anisotropy in the polarizability of the molecular wires.

The importance of the control of the overall morphology was confirmed by electrical measurements on disordered versus aligned samples, the latter showing an increase of an order of magnitude in electrical conductivity.

Figure. HAT5 is deposited on silicon substrates equipped with in-plane electrodes for conductivity measurements. In the left image self-aligned wires are formed using toluene as solvent while in the right image a disordered arrangement is achieved with chloroform.

* presenting author; E-mail: zzil33@snu.ac.kr