Hexabenzocoronene as a 1-D Organic Semiconductor in FETs

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Abstract:

Organic field effect transistors (FETs) have potential applications in low voltage, low cost, and mechanically flexible devices, including displays. However, organic FETs face problems of low mobility and high degradation relative to conventional inorganic FETs. Hexabenzocoronene (HBC) derivatives are organic semiconducting materials due to their strong interactions, and may self-assemble into 1-dimensional nanostructures in their liquid crystalline phase.

In this work, we studied the molecular packing of an HBC derivative, tetradodecyloxyhexabenzacoronene (THBC), by atomic force microscopy (AFM). In spin-cast films at room temperature, the molecules do not form perfect 1-D columns but are slipped, due to strong electron repulsion between large aromatic cores.

To align the THBC molecules, a thin layer of PTFE (Teflon®) fibers was deposited on Si/SiO_2 using a friction transfer method, forming grooves that may have guided the self-assembly of THBC.

The performance of FETs fabricated from films with and without the alignment was then compared.