

N-substituted pentacene's derivative thin film growth on TiO₂(110): morphology and electronic properties

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In the past two decades, N-heteroacenes as functionalized acenes have drawn more attention [1]. The introduction of nitrogen into the backbone of an acene molecule allows for stronger intermolecular interaction due to H-bonding.

We report on the investigation of the morphology and electronic properties of dihydro-tetraaza-pentacene (DHTAP) [2] thin films grown on rutile TiO₂(110) surfaces. The morphology of developed structures was studied by scanning microscopies (*in situ* STM, *ex-situ* AFM and SEM) and electron diffraction (LEED). Electronic properties were studied with KPFM and TPD spectroscopy. We've studied the influence of the built-in dipole moment of DHTAP on the properties of growing molecular monolayers on the TiO₂(110) substrate. Regular pentacene deposited on TiO₂(110) forms a compact monolayer (a wetting layer) with the molecular orientation strictly determined by the anisotropic substrate [3]. In comparison, the charge inhomogeneous DHTAP's monolayer consists of differently oriented molecules with respect to the substrate atomic rows, due to strong interaction with Ti and O atoms of the substrate. The dissimilarities also manifest in the work function of the molecular features and the desorption energy of the molecules. For the case of DHTAP multilayers, the molecules assemble into complex islands comprising multi-level "up-right standing" molecular arrangement.

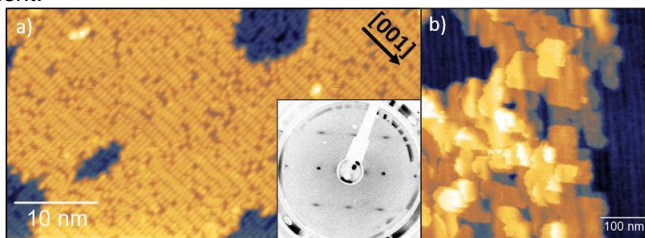


Fig. 1. a) UHV STM image of DHTA5 monolayer on TiO₂(110) substrate surface with LEED pattern inset; b) Ambient AFM image of DHTA5 multilayer island on TiO₂(110) substrate.

Keywords: Organic molecules, pentacene, DHTAP, DHTA5, dipole moment, UHV, STM, AFM, KPFM, LEED, TDS

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References:

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