Scanning tunneling microscopy and photoemission investigation of 2D Supramolecular Assembly of 4-DecyloxyBenzoic Acid on Au(111)

Marco Papagno

Dipartimento di Fisica, Università della Calabria, 87036 Arcavacata di Rende (Cs), Italy

Abstract

Two-dimensional (2D) supramolecular assemblies physisorbed on surfaces are a rich source of intriguing phenomena deriving from the properties of the molecules themselves and by the reduced dimensionality (2D). The nature and transformations of these systems may shed new light on the fundamental interactions between complex structures, opening new frontiers for basic research and technological development. Most of the self-assembled molecular networks (SAMNs) are easily obtained when specific substrates (the most commons are Au(111) and HOPG) are used as supports. The performance of these systems and devices utilizing is, however, strongly influenced by a complex balance of factors, such as structural order, molecular density, character, density of defects and molecular orientation. A precise knowledge and control over these factors is highly demanding for a rational design of highly ordered and well-oriented functional SAMNs. Despite several efforts, 2D molecular assemblies are generally characterized by low structural quality with small domain size and high density of structural defects. These factors hinder a proper structural and electronic investigation and prevent their integration into devices.
Recently, we demonstrated the fabrication of a flat 2D supramolecular assembly of 4-decyloxy benzoic acid (4DBA) on Au(111) and HOPG. The 4DBA network displays a weakly interacting single domain pattern extending over hundreds of square nanometers on the flat terraces of both substrates. The electronic structure investigation reveal different chemical environment of both C and O atoms of the 4DBA supramolecular assembly. Our experimental results are supported by both semi-empirical and density functional theory simulations.