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Fabrication of Mn-coordinated networks with dicarboxylic ligand molecules and their noncovalent binding of C60

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Introduction

In the traditionally bottom-up approach, superstructures are assembled by relatively weak interactions such as the hydrogen bonding, van der Waals or electrostatic forces with a limited thermal stability in these systems [1-3]. Metal-organic coordination networks (MOCNs) formed by coordination interaction between metallic center atoms and organic linker molecules have attracted wide attention [4]. Metal coordination interactions are stronger, directional and selective than the hydrogen bond, thus proved to be a widely adapted method in fabricating the molecule building blocks. Meanwhile, the metal-organic nanosystems present intriguing physical and chemical properties involved with magnetic, electronic, and catalysis et al [5-10].

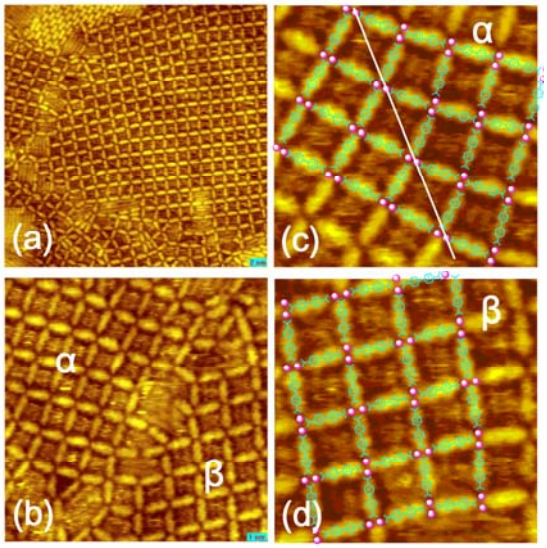
Experimental

The experiment was carried out with a home-built ultrahigh vacuum low temperature (scanning tunneling microscopy) STM system. The commercially available Stillbenedicarboxylic acid(abbreviated SDA) and 4,4'-biphenyldicarboxylic acid molecule (Alfa Aesar, ≥ 99%) was degassed and evaporated with a flux rate of about 1/3 monolayer(ML). The Au(111) substrate was hold at room temperature during the SDA or BDA molecule evaporation. Mn-coordinated networks were fabricated by depositing Mn atoms on the precursor layer, followed by annealing the sample to about 420K.

Results and discussion

We report the STM study of fabrication of Mn-based coordination networks on Au(111) substrate, with BDA and SDA as linker molecules. Two phases nominated as α and β phases, corresponding to rectangular and square networks, were observed to be driven by the substrate

induced different geometry of the node Mn atoms. Non-covalent binding of C60 molecule on the well-established nanogrids was investigated, where a dimer or a monomer was observed to be confined in one nanocavity.



(a) Large scale STM image for the ordered Mn-coordinated BDA networks (size: $30nm \times 30nm$). (b) Relatively high resolution STM image for a mixture of α and β phase with rectangular and square networks (upper left and lower right). (c) and (d) Schematic molecule model for the detailed arrangement of Mn atoms and BDA molecules (size: $7nm \times 7nm$).

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