

Self-assembly of DCA metal-organic network on different substrates.

D. Sostina¹, M. Muntwiler¹, T. A. Jung¹

¹Paul Scherrer Institute, 5232 Villigen PSI, Switzerland
daria.sostina@psi.ch

A promising route to functional systems with nanometre dimensions is the autonomous ordering and assembly of atoms and molecules on atomically well-defined metal surfaces [1]. The system under study here is the regular metal-organic network of 9,10-dicyano-anthracene (DCA) molecules on Cu(111) and Au(111) substrates. DCA molecules have two CN groups bonded to the centre phenyl ring of anthracene and form a stable porous network on both substrates at room temperature [2] as shown in Fig.1.

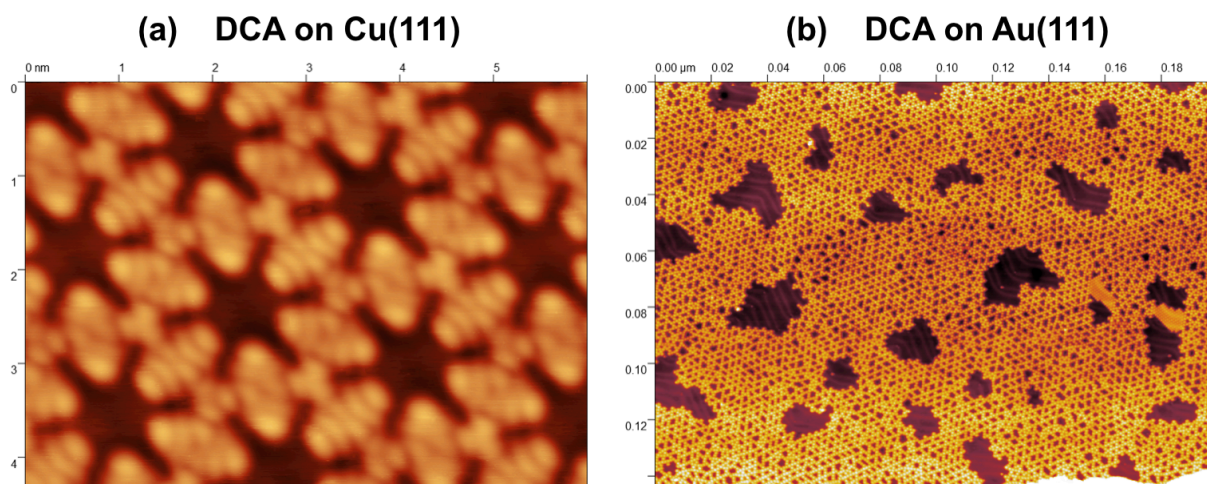


Fig.1 (a, b) - STM topography scans of DCA network on Cu(111) and Au (111) substrates respectively. (-0.5 V, 150 pA, 4.6 K, metallic tip).

In order to investigate the behavior of molecular electronic states we carry out STM/STS and ARPES measurements on two systems: DCA on Cu(111) and Au(111), both with attempt of oxygen doping. Our measurements show that the HOMO state on Cu(111) is shifted to region of lower binding energies when oxygen is adsorbed on the network. According to STM pictures, the absorption process manifests itself in the embedding of oxygen inside hollow positions of the molecular structure on Cu(111).

In the case of gold, STM reveals that two different kinds of networks co-exist on the sample surface. A first area is occupied by a hexagonal DCA network which involves more adatoms in its structure (Fig.1(b)). A second part of the sample is covered with an irregular molecular structure. In the case of gold that no HOMO peak can be detected in the same energy range as for copper substrate.

References:

- [1] J. V. Barth, G. Costantini, and K. Kern, *Nature* **437**, 671 (2005).
- [2] J. Zhang, et al., *Chem. Commun.* **50**, 12289 (2014).