“Fuzzy” adsorption of phthalocyanine molecules on metal passivated silicon surfaces

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Silicon surfaces passivated by metals provide high mobility of deposited phthalocyanine (Pc) molecules at room temperature and represent templates for studying self-organizing mechanisms in two dimensional molecular assemblies [1]. Defects in a surface reconstruction represent sites where the molecular adsorption can be stable and permanent [2].

Here we are focused on Si(111)-Sn($\sqrt{3}\times\sqrt{3}$) surface and copper phthalocyanine (CuPc) molecules. Observation of the reconstructed surface with a low coverage of the molecules by means of a scanning tunneling microscope (STM) at room temperature showed CuPc molecules captured at defect sites only. Fuzzy STM imaging of some molecules was investigated and a relation with adsorption at a pair of substitution defects was found – see Figure. Time records of tunneling current measured above “fuzzy molecules” showed prevailing two state fluctuations. Lifetimes of the states were investigated with respect of tunneling current, tip voltage and substrate temperature. Results indicate activation by the STM tip determined by tunneling conditions (the molecule can be removed from the adsorption position as well). Tunneling spectra were measured for crucial objects on the surface and analyzed for better understanding the adsorption instabilities.

The data will be compared with those we obtained for Si(111)-In($\sqrt{3}\times\sqrt{3}$) surface and other two types of Pc molecules – H_2Pc and F_{16}CuPc. A possible explanation of the observed fluctuations will be discussed.

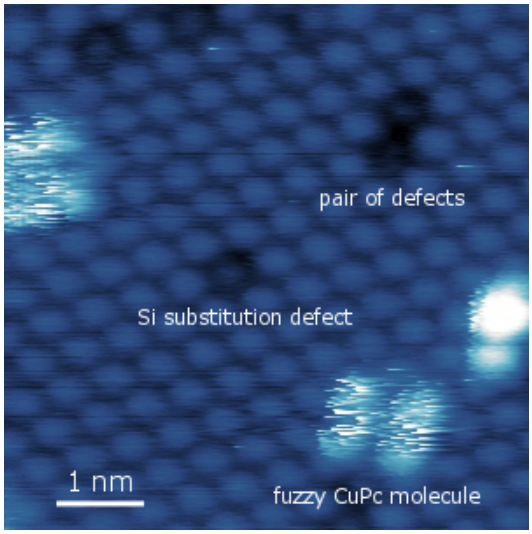

Figure: CuPc molecules on Si(111)-Sn ($\sqrt{3}\times\sqrt{3}$) surface

References:

[1] Peter Matvija, Filip Rozbořil, Pavel Sobotík, Ivan Ošťádal, Barbara Pieczyrak, Leszek Jurczyszyn, Pavel Kocán, Sci. Rep. **7**, 7357 (2017).
[2] Peter Matvija, Filip Rozbořil, Pavel Sobotík, Ivan Ošťádal, Pavel Kocán, J. Phys. Chem. Lett. **8,** 4268 (2017).