| ESRF | **Experiment title:** Adsorption of Phthalocyanine molecules on different metal surfaces | **Experiment number**: SI-1891 |
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**Report:**

In a series of ESRF beamtime projects we investigated geometric and electronic properties of organic-inorganic interfaces. Recently we concentrated on Metal-Phthalocyanine molecules adsorbed in submonolayers on Ag(111) (see reports on SI 1820, SI 1647 and SI 1529 as well as C. Stadler et al., Nature Physics **5**, 153 (2009), C. Stadler et al., New J. Phys **9**, 50 (2007) and C. Stadler et al., Phys. Rev. B **74**, 035404 (2006). Starting with this project SI-1891 we began to investigate the adsoption of such molecules on Au and Cu (111) oriented surfaces.

The interaction between molecules and these surfaces is different from the case og Ag(111). On Au(111) only a very weak bonding was found (physisorption). This leads to a much simpler phase diagram in the submonolayer range. The structure of the molecular layer is no longer influenced by the substrate but forms incommensurate structures merely due to van der Waals interaction within the layer. No repulsion between the molecules was found, in contrast to the case of Ag(111).

On the Cu(111) surface there was no indication for intermolecular repulsion either, however, for different reasons. Here the interaction across the interface is much stronger, the adsorption is more site specific and the molecules therefore are less mobile. The consequence is island-like growth of the molecules in different phases, many of which are commensurate.

In conclusion, we have found that the case of MePc molecules adsorbed on Ag(111) is sort of special in the sense that attractive (van der Waals) intermolecular interaction and repulsion

(induced by exchange of electronic charge with the substrate) are well leveled out. Consequently, molecular interaction can be switched for this system. Whether repulsion or attraction dominates is decided by external conditions like coverage and temperature. On Au and Cu surfaces intermolecular attarction dominates due to too small (in the case of Au) and too big (Cu) charge transfer between molecules and surfaces.

Publications on these results are in preparation or already submitted:

- Kröger, B. Stadtmüller, C. Stadler, J. Ziroff, M. Kochler, A. Stahl, F. Pollinger, F. Reinert, C. Kumpf, „Growth of copper-phthalocyanine submonolayers on Ag(111)", New J. Phys., submitted.
- B. Stadtmüller, I. Kröger, F. Reinert, C. Kumpf, „Submonolayer growth of CuPc on noble metal surfaces", in preparation.
- Kröger, B. Stadtmüller, P. Bayersdorfer, C. Kleimann, G. Mercurio, C. Kumpf, „Normal incidence x-ray standing waves study on copper-phthalocyanine submonolayers on Cu(111) and Au(111)", in preparation.