

Kelvin probe force microscopy on surfaces of UHV cleaved ionic crystals

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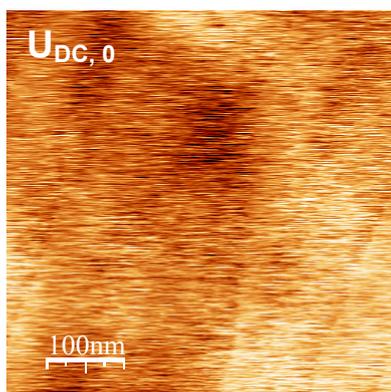
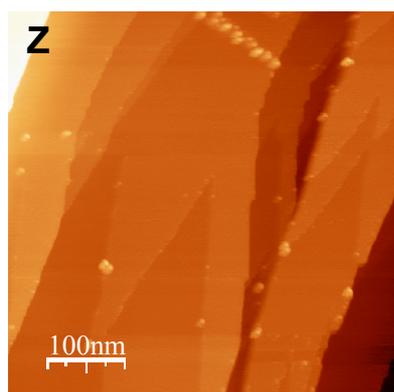
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If ionic crystals are cleaved in UHV, the crystal and especially the cleavage region suffers from plastic deformations due to the large stress during cleavage [1,2]. In most cases the crystal surfaces are charged afterwards whereas the strength of the charging depends on the material and can noticeably vary on the surface at nanometer scale [2,3]. Only a few work has been done so far in order to investigate systematically this charging phenomena although it might play an important role in many surface processes.

In this contribution we take the (001) surfaces of UHV cleaved MgO, NaCl and KCl as examples of charged surfaces. We show force spectroscopy and frequency modulated Kelvin probe force microscopy (KPFM) measurements which we performed on these surfaces. After a short introduction of both techniques we discuss first the strong charging of MgO crystals which appears after UHV cleavage [2]. We then present images of the residual surface charge distribution on the (001) surface of UHV cleaved and annealed MgO. The images show that the local surface charge strongly varies at nanometer scale and that some adstructures observed in previous measurements [1] exhibit a strong contrast in the KPFM image. In comparison, images taken on NaCl(001) and KCl(001) surfaces show a local charge distribution which varies more softly over distances of 50nm and more. In our images of all surfaces we observed differences of the surface potential of up to 1V and more and received a spatial resolution lower than 20nm in best cases. We performed KPFM images on same surfaces partially covered with nanometer sized gold clusters. On the NaCl(001) surface we observed only a faint contrast above clusters for small depositions (~ 0.01 ML) but a dramatically increased contrast above clusters for larger depositions (~ 0.3 ML).

Alongside the presentation of our results, an explanation for the contrast formation in KPFM of the considered surfaces will be given.



Topography image (**Z**) and image of the surface charge distribution (**$U_{DC,0}$**) taken on UHV cleaved NaCl(001)

- [1] C. Barth and C. R. Henry, Phys. Rev. Lett. **91**, 196102 (2003)
- [2] C. Barth, C. Claeys and C. R. Henry, accepted for publication in Rev. Sci. Instr.
- [3] C. L. Pang, T.V. Ashworth, et al., Nanotechnology **15**, 862 (2004)