NC-AFM Investigations on Metal-Phthalocyanines Deposited on KCl(001) Surfaces

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Noncontact atomic force microscopy (NC-AFM) is a powerful tool for imaging organic samples on a molecular scale. While several investigations have been conducted on molecular-scale imaging of organic thin films deposited on metals and semiconductors these years, there have been only a few studies made on molecules on insulators [1, 2]. Molecular-scale investigations on insulating substrates are indispensable for the molecular electronics where individual molecules as electrically active channels are placed on insulating substrates.
In this study, we investigated metal-phthalocyanine (MPc) molecules deposited on KCl(001) surfaces by NC-AFM. Figure 1(a) shows a large-scale NC-AFM image of lead-phthalocyanine (PbPc) films on KCl(001) surfaces. Two semicircular PbPc domains grown from the atomic step edges of the substrate are clearly seen. Figure 1 (b) shows an NC-AFM image of the substrate obtained on the area indicated by the white square in fig. 1(a). We can see periodic stripes of the Cl^- ions running in the direction of KCl[110]. Figure 1 (c) shows a molecular-resolution image of the PbPc domain with a square lattice of 1.3 nm × 1.3 nm. The area corresponds to the black square in fig. 1(a). The direction of the PbPc molecular rows was assigned with respect to the KCl[100] direction by comparing fig. 1(b) and (c). The angle between the molecular rows and the KCl[100] direction is 27 °, which agrees well with the previous RHEED study [3].

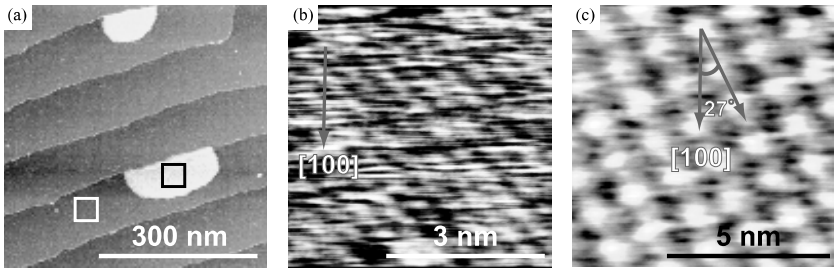

Fig. 1 NC-AFM images of PbPc films on KCl(001) surfaces (a) 500 nm × 500 nm, Δf = - 22 Hz (b) 5 nm × 5 nm, Δf = - 105 Hz (c) 8 nm × 8 nm, Δf = - 100 Hz

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