# Atomic Scale Investigation of Schottky Barrier Formation: Lead on Si(111)

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Previous macroscopic measurements [1,2] have shown that Schottky barrier heights for Pb films grown on Si(111) depend sensitively on the atomic structure at the interface. However, since the structural phase diagram for the Pb/Si(111) system is complex with many coexisting phases [3], atomically-resolved studies are sorely needed for developing a systematic and precise understanding of the barrier height at the interface.

Using non-contact atomic force microscopy, we have determined the contact potential difference (CPD) of multiple structural phases in the Pb/Si(111) system. Furthermore, we have tracked the barrier formation "layer-by-layer" by observing multilayer structures.

Fig. 1 shows the CPD map acquired for a mixed phase surface with 1×1 and √3×√3R30° phases.

We will discuss the origin of the observed CPD contrast between different phases and thicknesses of the Pb films in light of recent theoretical calculations. In addition, we will present the effect of the reduced dimensionality to the observed electrostatic potential variation at boundaries between different phases.

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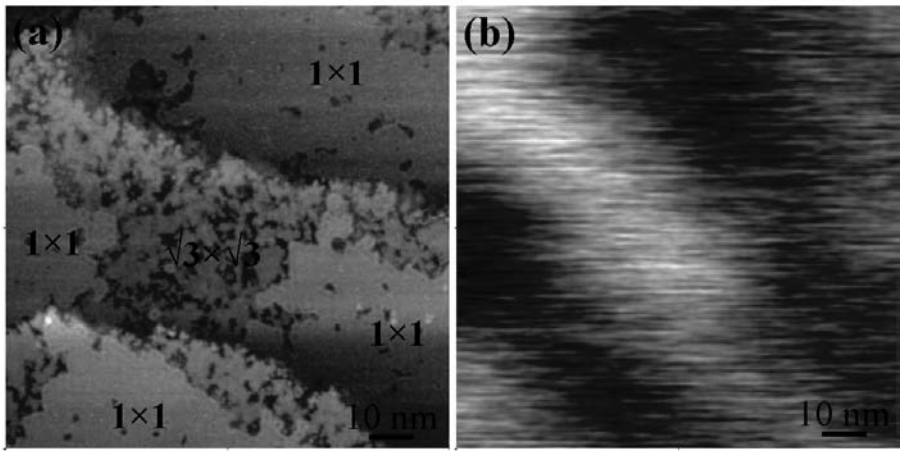


Fig. 1 (a) STM image of a mixed-phased surface. (b) CPD map acquired at the same location.

[1] D.R. Heslinga, et al., Phys. Rev. Lett. 62 1589 (1990).
[2] X. Tong, K. Horikoshi, and S. Hasegawa, Phys. Rev. B 60 5653 (1999).
[3] T.-L. Chan et al., Phys. Rev. B 045410 (2003).