Lateral Force Microscopy Study of Copper Oxide

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A laterally oscillating tip can be used in a small-amplitude FM-AFM setup, i.e. lateral force microscopy (LFM), to probe the conservative (frequency shift, Δf) and non-conservative (dissipated energy, E_{diss}) components of the tip-sample interaction. Tips terminated with a CO molecule are used not only to enhance imaging, but also to probe E_{diss}: When laterally stroking a pair of atoms perpendicular to the oscillation direction, the CO molecule acts as a torsional spring snapping over the chemical bond, resulting in energy dissipation. Here, a Cu(110) surface partially oxidized in the (2×1)O reconstruction is studied. The individual oxide rows are oriented perpendicular to the oscillation direction of the sensor, allowing for repeatable measurements. The z-progressions of Δf and E_{diss} are then investigated in order to compare the signal ranges and distributions to previous work. Furthermore, we performed simulations to study the CO dynamics of the snapping mechanism in detail. DFT-based calculations allow us to fully relax the surface and to include the effects of electrostatics.

Reference

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