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Vertical NC-AFM Atom Manipulation without Tip Change JOSEPH BAMIDELE, Dept. of Physics, King's College London, UK, ROBERT TURANSKY, Inst. of Physics, Slovak Academy of Sciences, Bratislava, YASUHIRO SUGAWARA, Dept. of Appl. Physics, Osaka University, Japan, IVAN STICH, Inst. of Physics, Slovak Academy of Sciences, Bratislava, LEV KANTOROVICH, Dept. of Physics, King's College London, UK — We present a joint experimental and theoretical study of vertical manipulation of "super"-Cu atoms on the oxygen-terminated $p(2 \times 1)$ Cu(110) surface with Non-Contact Atomic Force Microscopy (NC-AFM). Using NC-AFM we find that, using an O-terminated tip [1] vertical manipulation events consisting of removal are very rare, and, contrary, deposition processes of Cu atoms are very frequent. Interestingly, no change of contrast is observed, meaning that the vertical manipulation retains the tip apex unchanged. The experiments are supported by theoretical study using DFT calculations in conjunction with nudged elastic band method for calculating transition barriers, as well as kinetic Monte Carlo (KMC) simulations for accessing the tip-related time-scales. We propose detailed mechanism of the vertical manipulation, which fully explain experimental observations, including the removal/deposition probabilities. The mechanism consists of several stages: two stochastic (thermal with an energy barrier) and one conservative (dragging), which happens in between. KMC simulations confirm the viability of this mechanism and give statistics information.

[1] J. Bamidele et al.; Phys. Rev. B 86, 155422 (2012).

Ivan Stich Inst. of Physics, Slovak Academy of Sciences, Bratislava

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