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Novel Scanning Tunneling Spectroscopy for Volatile Adborbates

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Reactive or unstable adsorbates are often difficult to study spectroscopically. They may have, for instance, resonance states lying close to the Fermi level, inducing them to desorb or decompose by the probe itself, low-energy tunneling electrons. In order to overcome this limitation, we developed a novel method, which we call x-ramp scan. The method sweeps the bias voltage, with the simutaneous scan along the imaging direction, in a constant current mode. This mapping yields the tip-height variation as a function of bias, or Z(V), at nominally always fresh surface. We applied this method to the investigation of methanol-induced molecular features, attributed to methoxy, found on NiAl(110) surface. These were produced by methanol molecules deposited by a pulse injection method onto the metallic surface. Our study shows adsorbed methoxy are very reactive to the bias voltage, rendering the standard spectroscopy useless. Our new x-ramp scan shows that the decomposition of adsorbates occurs at the sample bias of 3.63 V, and proceeds with the lifetime of a few milliseconds. The details of the method will be provided at the discussion.