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Atomic-scale resolution of Scanning Probe Microscopy in air and liquid environment

Abstract
Atomic resolution of scanning probe microscopy (SPM) is essential for investigating atomically controlled surface or interface of liquid and crystal. By optimizing scanning conditions as well as hardware specifications, we are able to build a high resolution SPM, capable of atomic scale imaging. The compact size of the microscope allows to reduce mechanical vibration noise, and its reduced piezo scanner is suitable for imaging the structure of a crystal lattice. A sample stage and cantilever motion sensors are automatically controlled using piezo motors, which is crucial for experimenting patterned samples in vacuum or liquid. As a demonstration of the microscope, we show the crystal structure of mica and HOPG obtained in air and the lattice structure of calcite in water. In addition, a high resolution of electric current imaging in HOPG is presented at the atomic scale. The optimized SPM can be useful for observing atomic-scale phenomena on 1-D materials, 2-D materials, or liquid-solid interfaces.