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Measuring infrared absorption of molecular adsorbates at the submonolayer level by scanning tunneling microscopy-based IR spectroscopy (IR-STM) IVAN V. PECHENEZHSKIY, GIANG D. NGUYEN, XIAOPING HONG, Department of Physics, University of California at Berkeley, Berkeley, California 94720, JEREMY E. P. DAHL, Stanford Institute for Materials and Energy Science, Stanford University, Stanford, California 94305, FENG WANG, MICHAEL F. CROMMIE, Department of Physics, University of California at Berkeley, Berkeley, California 94720 — Here we present a simple, effective technique whereby a scanning tunneling microscope (STM) can achieve vibrational spectroscopy of molecular adsorbates at the submonolayer level through the use of a tunable infrared (IR) laser source. By using the STM as a detector to probe the IR molecular response, the technique takes advantage of the high spectral resolution inherent to IR measurements while avoiding the typical difficulties related to optical detection. This technique also allows sub-nm scale spatial mapping of surface structure under the same experimental conditions that the STM-IR absorption spectra are acquired (sub-nm spatial resolution for specific IR spectral features has not yet been achieved). Using this technique we have obtained IR absorption spectra of higher diamondoid molecules, specifically [121]tetramantane and [123]tetramantane, deposited on a Au(111) surface. The significant differences between the IR-STM spectra obtained for these two molecular isomers show the power of this new technique to differentiate chemical structures.

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