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Electron Phonon Interaction at the Si(111)-7×7 Surface I. BARKE, FAN ZHENG, A. KONICEK, R. HATCH, F.J. HIMPSEL, Dept. of Physics, University of Wisconsin Madison, 1150 University Ave, Madison, WI 53706 — In recent years, it has become possible to study the electron-phonon interaction of metals by high resolution photoelectron spectroscopy. However, virtually no such experimental information is available for the case of semiconductors. It is shown that electron-phonon interaction at the Si(111)-7 × 7 surface provides a natural explanation for the unusual band dispersion of the metallic surface states. While local density theory predicts a hole-like dispersion for the adatom bands that cross the Fermi level E_F, photoemission finds an electron-like band with a break in the slope at 0.1 eV below E_F. Such behavior follows naturally from electron phonon interaction with the surface phonon mode at $\hbar\omega = 70$ meV that dominates electron energy loss spectra. It has been assigned to adatom vibrations by molecular dynamics calculations. Two independent determinations of the electron-phonon coupling parameter from the band dispersion and the temperature dependent phonon broadening yield very similar coupling parameters around $\lambda = 1.1$.

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