Resolving surface phonon modes using scanning tunneling spectroscopy

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Scanning tunneling microscopy (STM) is a powerful to understand not only electronic structure but also bosonic modes on surfaces. Inelastic tunneling spectroscopy (IETS)-STM was successful to measure vibrational spectrum of single molecule and surface phonon modes. However, unlike single molecular vibration spectroscopy, to resolve bosonic modes on surface, especially when interacting with electrons, is still a challenging subject. In this talk, I'll represent tunneling conditions capable of phonon measurement on Cu and oxygen adsorbed Cu surface. Selective resolution of surface phonon based on the symmetry of phonon modes and spatial variation due to strain relaxation will be discussed. We also resolved phonon modes playing a role as pairing glues on superconducting monolayer FeSe film on $SrTiO_3$(100) substrate. Unlike bulk FeSe, the presence of the interface with TiO_2 surface allows the substrate phonons to affect the superconducting layer. Those phonon modes can be explained by Eliashberg theory, which uses strong electron-phonon coupling. In addition, spatial variation of d^2I/dV^2 maps at phonon energies provide additional clue for the interface phonon contribution to the superconductivity.