

Applications of field emission resonances on nano-scale measurements

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Field emission resonances (FERs) in scanning tunneling microscopy (STM) is a phenomenon in which the field emission electrons emitted from the microscope tip couple into the quantized standing-wave states within the STM tunneling junction. Although FERs originate from the quantized states in vacuum, they actually can contain the information associated with physical properties of the surface and the STM tip. We demonstrate that FER energies can be used to measure the local work function of the surface. FER intensities can reflect the local electron transmissivity of the reconstructed surface. The zero valley intensities appearing around the FER can indicate that the observed material has the band gap above the vacuum level. FER energies combining with *Z-V* spectroscopy can be utilized to characterize the potential form in STM junction. Characterization of the potential form can be applied to measure the barrier width of the field emission, and quantify the sharpness and the field enhancement factor of an STM tip.