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Low Energy Hot Electron Scattering in Nanometer Scale Metal Films Using Ballistic Electron Emission Microscopy JOHN GARRAMONE, JOSEPH ABEL, VINCENT LABELLA, College of Nanoscale Science and Engineering, University at Albany, SUNY, Albany, New York 12203, USA — Inelastic and elastic scattering lengths of hot electrons have been measured at low energies (<2 eV) in nanometer thick silver films utilizing ballistic electron emission microscopy (BEEM). BEEM is a scanning tunneling microscopy (STM) based technique that is capable of injecting electrons a few eV above the Fermi level and utilizes a third collector contact on the semiconductor of a Schottky diode[1]. Electrons tunnel from the STM tip into the metal base layer and a small fraction of these electrons travel ballistically to the metal/semiconductor interface. Electrons with energy greater than the Schottky barrier height (SBH) are collected as BEEM current. The silver attenuation length is extracted by measuring the BEEM current as a function of the Ag overlayer thickness over a series of samples for both electron and hole injection. The relative contribution of inelastic and elastic scattering is extracted by modeling the change in attenuation length with respect to the tip bias. A drastic increase in the attenuation length is observed as energies approach the SBH, which we attribute to the ballistic nature of the electrons and holes that are collected at these energies.

[1]L. D. Bell, et al., Phys. Rev. Lett. 61 2368 (1988)

John Garramone
College of Nanoscale Science and Engineering, University at Albany,
SUNY, Albany, New York 12203, USA

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