Surface roughness and surface-induced resistivity of gold films on mica: Application of quantitative scanning tunneling microscopy

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We report measurements of the resistivity (Formula presented) of a gold film 70 nm thick deposited on mica preheated to 300 °C in UHV, performed between 4 and 300 K, and measurements of the surface topography of the same film performed with a scanning tunneling microscope (STM). From the roughness measured with the STM we determine the parameters ? (rms amplitude) and ? (lateral correlation length) corresponding to a Gaussian representation of the average height-height autocorrelation function (ACF). We use the parameters ? and ? to calculate the quantum reflectivity R and the increase in resistivity induced by electron-surface scattering on this film, according to a modified version of the theory of Sheng, Xing, and Wang (mSXW) [Munoz et al., J. Phys.: Condens. Matter 11, L299 (1999)]. The mSXW theory is able to select the appropriate scale of distance over which corrugations take place, leading to (Formula presented) for corrugations taking place over scales of distances that are lon