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Reduced Conductivity of Nano-Rough Copper Surfaces at 650 GHz[1] M.P. KIRLEY, NILS CARLSSON, BENJAMIN B. YANG, J.H. BOOSKE, University of Wisconsin-Madison — Effective design of powerful sources and efficient components for terahertz (THz) regime radiation requires knowledge of dissipation losses caused by conducting surfaces. However, theoretical predictions for the effect of roughness on the reflectivity of surfaces are untested in this frequency regime. Measurements of the electronic properties of metals and semiconductors are performed using a high quality factor quasi-optical (QO) hemispherical resonator operating at 650 GHz. Large area (> 1 cm $\times$ 1 cm) copper surfaces with controlled nanoscale surface roughness are fabricated using either an abrasive process or a chemical etching process. Measurement of the reflectance of the samples shows the increased resistivity of the metal due to the surface features. These measurements are compared to approximate theoretical predictions developed by Hammerstad and Bekkadal, rigorous theoretical predictions developed by Tsang et al. and computational simulations. Comparisons show a deviation between measurement and theory when the average roughness of the surface is less than one skin depth in copper at 650 GHz. We suspect that the grain size of the copper metal could play an important role in the discrepancy.

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