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Imaging and Analysis of THz Surface Plasmon Polariton Waves with the Integrated Sub-wavelength Aperture Probe

Source

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Abstract

We demonstrate that the integrated sub-wavelength aperture probe designed for THz near-field scanning probe microscopy can be used to map surface plasmon waves at THz frequencies. Observed near-field images of metallic patterns reveal surface plasmon waves superimposed over THz transmission images. We discuss the coupling mechanism for the surface waves and arrive to an important conclusion that the detected surface wave images represent the spatial derivative of the surface plasmon electric field. The relationship between the electric field and the measured signal is confirmed experimentally by mapping surface waves in bow-tie antennas. This study explains previously observed effects in THz near-field microscopy and provides a framework for analysis of near-field images.