Transmission of surface plasmon polaritons through nanometric constrictions

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We study the excitation and propagation of surface plasmon polaritons (SPPs) on few micrometer wide gold stripes with thickness of about 100 nm. For the excitation of SPPs we use an optimized line grating in the stripe. The surface plasmons propagate towards and across a suspended constriction. The geometry of the constriction includes bowtie shapes with lateral sizes well below the plasmon wavelength and down to the atomic scale as well as slit gaps, see Figure 1 (a). The plasmon transport is detected by recording the outcoupled light at constrictions and at gratings located on the other side of the constriction [1] (see Figure 1 (b) and (c)) as well as by conductance measurements through single-atom contacts and vacuum gaps [2]. We show that SPPs are transmitted with high probability across the constrictions. Furthermore, we present an all-optical technique to detect quantitatively the heat transport associated with the SPP transport [4,5]. For comparison we performed FDTD (Finite Difference Time Domain) simulations with the program package Lumerical as well as with the finite element program Comsol Multiphysics and find good agreement with the optical signal [3,4,5].

![Figure 1. a) Scanning micrograph of a sample with four gratings and a constriction; b),c) Optical images of a sample irradiated at grating 1 for (b) p-polarization and (c) s-polarization](image_url)

References

5. Th. B. Möller, A. Ganser, M. Kratt, S. Dickreuter, R. Waitz, E. Scheer, J. Boneberg, P. Leiderer, under review.

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