Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Surface Plasmons in Anisotropic Metal-Dielectric Structures ARKADII KROKHIN, Department of Physics, University of North Texas, Denton, TX 76203, KEMAL BAGCI, Department of Physics, University of North Texas, ARUP NEOGI, Department of Physics, University of North Texas — We study the effects of anisotropy of a dielectric substrate and a metal film on the dispersion relation and range of propagation of surface plasmons. The substrate is considered to be a uniaxial crystal with its axis perpendicular to the metal surface. The dielectric constants of the substrate are $\varepsilon_{||}$ (in the plane of propagation) and $\varepsilon_{\perp}$ (in the perpendicular direction). The metal film is characterized by a complex dielectric tensor with isotropic real negative part $\varepsilon'(\omega)$and anisotropic positive imaginary part $\varepsilon''_{ik}(\omega)$. The latter has two different components$\varepsilon''_{||}(\omega)$ and $\varepsilon''_{\perp}(\omega)$. Anisotropy of the dissipative part of the dielectric tensor is due to the surface channel of electron scattering, leading to the lower ac conductivity of the thin film in the direction perpendicular to the metal surfaces. We show that the substrate with $\varepsilon_{\perp} > \varepsilon_{||}$ gives rise to larger propagation length of the surface plasmon. Thus from the point of view of efficiency of the plasmonic devices anisotropic *negative* uniaxial crystals are preferential. In this case the decay length of the plasmon field in the substrate also increases. This decay length is an important characteristic of the sub-wavelength optical resolution.

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Date submitted: 08 Dec 2004 Electronic form version 1.4