Comment on "Surface-Plasmon Energy and Dispersion on Ag Single Crystals"

A recent Letter by Suto et al. [1] reported on measurements of surface-plasmon energy on the (111) and (011) faces of silver. They found a dependence on the crystal surface and, in the case of Ag(011), on the direction of the surface-plasmon momentum $q_\parallel$. They explained their finding by claiming contributions to the dielectric response from surface direction.

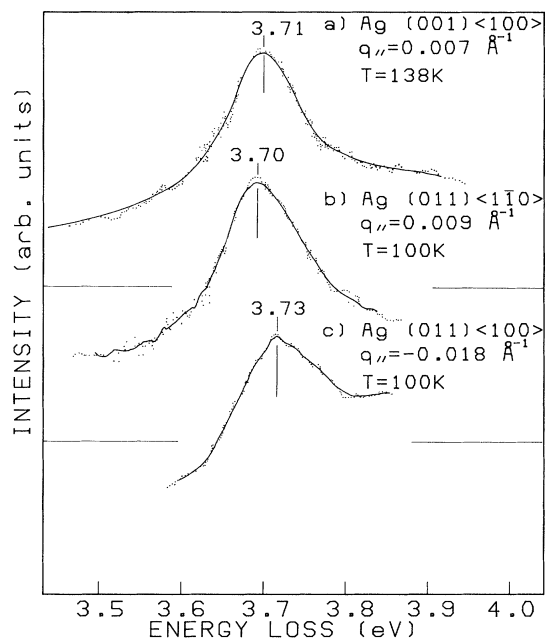We repeated the electron-energy-loss experiment on

FIG. 1. Sample spectra taken at $q_\parallel \approx 0$. The spectra were recorded with a resolution of 25 meV in the following conditions of impact energy E_i, incident angle θ_i, and scattering angle θ_s: (a) $E_i = 16.00$ eV, $\theta_i = 60.5°$, $\theta_s = 81.3°$; (b) $E_i = 8.41$ eV, $\theta_i = 47.2°$, $\theta_s = 76.4°$; (c) $E_i = 17.20$ eV, $\theta_i = 59.7°$, $\theta_s = 80.1°$.

Ag(011) in the same experimental conditions as Suto et al. We could not reproduce the above cited results. As shown in Fig. 1 at $q_\parallel \approx 0$ the surface-plasmon energy reads 3.70 eV along $\langle 1\bar{1}0 \rangle$ and 3.73 eV along $\langle 001 \rangle$. These values are compatible with the surface-plasmon energy of 3.69 eV measured for Ag(001) at room temperature [2] and with the new data collected on the same surface at low temperature (3.710 eV at a crystal temperature of 138 K [3]). The width of the surface-plasmon loss peaks measured in our experiment are 110 meV on Ag(011) along $\langle 1\bar{1}0 \rangle$, 100 meV on Ag(011) along $\langle 100 \rangle$, and 92 meV on Ag(001) along $\langle 100 \rangle$ [3]. The observed differences in surface-plasmon energy are therefore smaller than their half-width. Moreover, on Ag(111) Suto et al. [1] and Contini and Layet [4] find the surface-plasmon energy at 3.69 eV. The conclusions of Suto et al. appear therefore, in the light of the present results, without foundation. In addition we point out that the surface plasmon of Ag(011) along $\langle 1\bar{1}0 \rangle$ is lower in energy than the bulk plasmon of Ag (3.78 eV) [5] contrary to what was reported by Suto et al. This result indicates that surface-plasmon energy is simply determined by the bulk properties as expected.

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