[V-1] [초청]

Collective Excitations in Thin K Films on Al(111)

Bong-Ok Kim
Department of Physics, University of Pennsylvania, PA 19104, U.S.A.

The surface collective modes of thin K films deposited on Al(111) have been investigated using frequency dependent photoyield measurements and momentum resolved inelastic electron scattering. Jellium based theoretical calculations have predicted a richer set of features in the thin films than for the surface of a semi-infinite solid because there are the interference between two interfaces (substrate-film and film-vacuum) and heavy damping on the substrate.

The use of an optical probe and electron scattering has allowed us to draw a more complete picture of the dynamic screening in thin films. The number, dispersion, damping and optical activity of the collective modes of the thin films have been measured as a function of K film thickness.

New overlayer-induced excitations are observed: At $q_{\parallel} = 0$, they correspond to the antisymmetric slab mode and the multipole surface plasmon. At finite $q_{\parallel} = 0$, these modes undergo a transition towards the K multipole and monopole surface plasmons. With increasing coverage, the overlayer excitations turn into the collective modes of semi-infinite K. For a consistent interpretation of photoyield and electron energy loss spectra it is crucial to account for the non-analytic dispersion of the overlayer modes at small parallel wave vectors and for the finite angular resolution of the detector. The observed dispersions confirm predictions based on the time-dependent density functional approach.