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Dispersion and Mirage of Surface Plasmon Waves in Metallic Photonic Crystals[1] CHEUNG WAI CHAU, YUN SAN CHAN, MING JIE ZHENG[2], KIN WAH YU, The Chinese University of Hong Kong — We have studied the dispersion and propagation of surface plasmon (SP) waves in a one-dimensional metallic photonic crystal composed of metal-dielectric multilayered films by a transfer matrix method. By virtue of Bloch theorem, we are able to obtain the dispersion (frequency-wavevector) relation for arbitrary oblique propagation of SP waves for various non-zero transverse wavevectors. Model calculations are performed for alternative gold and MgF_2 films to obtain the photonic band-gap structure. For a progressively decreasing gold film thickness, the band (gap) width increases (decreases), rendering a precise and feasible tunability of photonic band gaps. Moreover, by imposing a gradual variation in the thickness of dielectric along the multilayers, it is possible to alter the dispersion relation locally, allowing us to study the bending of SP wave at various incident angles. We use Hamiltonian optics approach to obtain the trajectories of propagation. As the transverse wavevector is a constant of motion for a certain incident angle, we obtain different mirage at various oblique incidence. The results are useful for achieving superbending of SP waves.

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