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Understanding of extraordinary optical transmission in metallic nano-hole array via plasmon dispersion BOKYUNG SONG, CHANG-HEE CHO, Daegu Gyeongbuk Institute of Science and Technology, DEPARTMENT OF EMERGING MATERIALS SCIENCE TEAM — Extraordinary optical transmission (EOT) is a phenomenon that shows high optical transmission through sub-wavelength hole array on metallic thin film. Understanding of this EOT behavior and designing the structure for tunable optical transmission are crucial for applications to EOT-based devices such as biosensors, color filters, and transparent electrodes. In this study, the transmission properties of EOT in Ag nano-hole array with variable periods are investigated through a comparison between optical transmission and surface plasmon polariton (SPP) dispersion, which is believed to be directly correlated with EOT. To examine the optical transmission properties, Ag nano-hole arrays with variable periods are fabricated using electron-beam lithography. The measured optical transmission spectra are in good agreement with calculated spectra. We found that these EOT behaviors can be explained by analyzing the parameters of the SPP dispersion such as the group velocity and the momentum matching between SPPs and photons. Also, we show that EOT-based Ag nano-hole arrays with high optical transmission in broad wavelength region can be utilized for transparent electrodes. Our results indicate that EOT can be engineered in a wide range by tuning the SPP dispersion.

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