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Ultrafine and Smooth Full Metal Nanostructures for Plasmonics XINLI ZHU, JASENG ZHANG, JUN XU, ZHIMIN LIAO, XIAOSONG WU, DAPENG YU, School of physics, Peking University, Beijing, China — Surface plasmon polaritons (SPPs), which are coupled excitations of electrons bound to a metal-dielectric interface, show great potential for application in future nanoscale photonic systems due to the strong field confinement at the nanoscale, intensive local field enhancement, and interplay between strongly localized and propagating SPPs. The fabrication of sufficiently smooth metal surface with nanoscale feature size is crucial for SPPs to have practical applications. A template stripping (ST) method combined with PMMA as a template was successfully developed to create extraordinarily smooth metal nanostructures with a desirable feature size and morphology for plasmonics and metamaterials. The advantages of this method, including the high resolution, precipitous top-to bottom profile with a high aspect ratio, and three-dimensional characteristics, make it very suitable for the fabrication of plasmonic structures. By using this ST method, boxing ring-shaped nanocavities have been fabricated and the confined modes of surface plasmon polaritons in these nanocavities have been investigated and imaged by using cathodoluminescence spectroscopy. The mode of the out-of-plane field components of surface plasmon polaritons dominates the experimental mode patterns, indicating that the electron beam locally excites the out-of-plane field component of surface plasmon polaritons, and quality factors can be directly acquired. Numerous applications, such as plasmonic filter, nanolaser, and efficient light-emitting devices, can be expected to arise from these developments.

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