

**Plasmonic Silver Nanoparticle Cluster Arrays by using PS-*b*-P4VP Crew-cut Micelle**

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Surface-enhanced Raman scattering (SERS) substrates have been fabricated by either bottom-up method or top-down approach. The former, for instance, particle growth in a solution, is very easy, but the uniformity of the size and the inter-particle distance become very poor, resulting in only a few places working as the hot spots. On the other hand, the latter based on electron-beam lithography allows one to have precise control of nano-pattern. But, the fabrication of nano particles (or patterns) with an inter-particle (or pattern) distance down to 10 nm on a large area (several cm<sup>2</sup>) is very difficult. In this study, we achieve easy fabrication of silver nanoparticle with interdistance down to 10 nm by using crew-cut type polystyrene-block-poly(4-vinylpyridine) copolymer (PS-*b*-P4VP) micelles. The inter-particle distance was carefully adjusted by using different block ratios and total molecular weights of PS-*b*-P4VP. After the micelle solution was spin-coated on Si wafer to form the monolayer of the micelles, the block copolymer was removed completely by reactive ion etching. We obtained a maximum SERS enhancement factor up to  $\sim 10^8$  with an excellent reproducibility.