SERS Performance in Self-Assembled Silver Nanocluster Arrays via Block Copolymer Micelles

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Surface Enhance 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 becomes very poor. Thus, only a few places play as a role of 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 nanoparticles (or patterns) with an inter-particle (or pattern) distance down to 10 nm on a large area (several cm^2) is very difficult.. In this study, we solve both problems by fabricating the high density array of silver nanoclusters by using crew-cut type polystyrene-block-poly(4-vinylpyridine) copolymer (PS-b-P4VP) micelles. Silver cluster was analyzed by high resolution Transmission Electron Microscopy and SERS effect was measured through all sample areas. We obtained a maximum SERS enhancement factor up to ~10^8 with an excellent reproducibility.