Au decorated self-ordered Al nanoconcavities as a SERS platform

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Surface-enhanced Raman scattering (SERS) has attracted extensive interest due to its promising applications in chemical/biological sensing and biomedical diagnostics. In nanotechnology, we mimic the fascinating honeycomb configuration on Aluminum (Al) substrate and its adaptable functionalizations utilizing Au sputtering process [1,2]. Herein, we demonstrate the synthesis of the Al Nano bowl morphology with the deposition of Au nanoarray patterned by a sputtering technique. Al templates were synthesized through a two-step anodization process using phosphoric acid. First, a self-ordered pore structure of anodic alumina (AAO) was fabricated through hard anodization (HA) of Al templates using phosphoric acid (195 V) [3]. The second step of anodization was performed with the same parameters of temperature and voltage for 3 h. To acquire the nano bowled morphology on the surface of the Al template as shown in Figure 1(a), the AAO samples were immersed in the stirring assertive mixture of chromium trioxide (0.2 M) and phosphoric acid (0.42 M) for 2 h at 70 ºC. Then Au was sputtered (200 sec) on the resultant Al concavities for further functionalization shown in Figure 1(b). The size of the resultant nanoparticles relies on the sputtering time and thickness of the Au film as followed by Al template morphology [4]. When the Au-coated honeycomb-like nanoarrays will treat to thermal annealing, the Au layer initiates to act with the topography of synthesized nano concavities. This work reveals the efficient strong mechanism to assemble the Au nanoparticles onto dense electrochemically synthesized nanoarrays having a honeycomb-like structure with high spatial resolution. Their plasmonic properties are determined experimentally over a wide range from visible to NIR region, demonstrating to be an efficient substrate for highly sensitive applications, especially for SERS. These interstitial spots were considered to owe concentrated electromagnetic fields conjugated with intense localized surface plasmon resonance [5]. For the occurrence of interparticle plasmon coupling, separation distance among the particles should be less, which will resultantly lead to a significant increment of near field intensity as well SERS or an increase of LSPR refractive index sensitivity [6].

References

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Figures

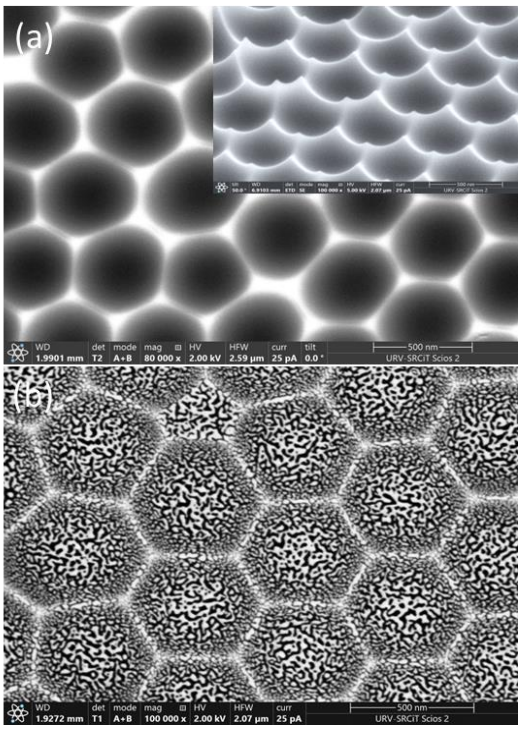

Figure 1. FESEM images (a) Top and tilted view of Al concavities and inset the tilted image of nano bowled structure without Au sputtering. (b) Al nano bowled template with Au sputtering of 200 sec.

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