Fabrication of SERS-Active Substrate Using Electrodeposited Silver with Nanoscale Dendrites

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Surface-Enhanced Raman Scattering (SERS) phenomenon is known to increases the intensity of Raman scattering for molecules, when they are adsorbed onto the surface of noble metals spieces[1]. In the present work, we attempted to fabricat the SERS-active substrates using electroplating method, which has capability to form 3-dimenssional metallic structures in nm scale.

Figure 1 shows schematic images of the preparation process of the SERS-active substrates. First, Cr and Cu seed layers were formed onto the SiO_2 substrate by sputtering and lift-off processes, followed by chemical mechanical polishing (CMP) treatment to reduce the thickness of the Cu seed layer. Then the Cu surface was coated with Au by using the displacement type deposition process. The solution for the Au displacement deposition contained Ni ions in order to minimize the roughness of the deposited Au film[2]. Finally, the Ag film with nanoscale dendritic structure was electroplated onto the surface of the substrate.

Figure 2 shows representative SEM image of the Ag deposits nucleated from the Au cathode and grew toward the anode at the surface. It was confirmed that the nanoscale Ag deposits grew laterally on the surface. In order to confirm their SERS activity, Raman-scattering measurement of the substrate, which was coated with carbon, was performed.

The results are shown in Fig. 3, which clearly shows that Raman-scattering signal is enhanced, indicating the SERS activity of the substrates prepared by this process.

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References 1 B. J. Bozzini, *J Electroanal Chem* **563**, 133 (2004). 2. M. Saito, T. Koizumi, K. Tsutsui, J. Mizuno, T. Edura, M. Tokuda, H. Onozato, Y. Wada, T. Homma, M. Haemori, H. Koinuma, Abs. 46, 205th Meeting of the Electrochemical Society (2004).

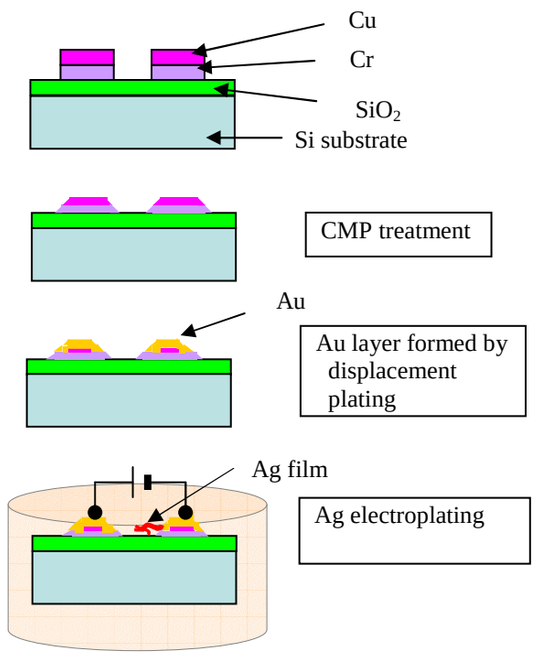

Fig. 1. Fabrication process for the SERS-active substrate.

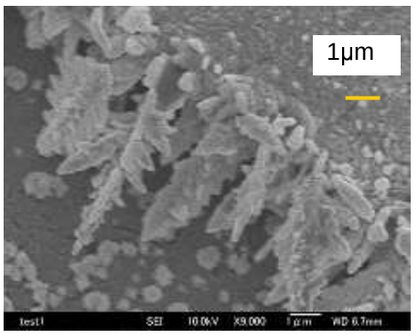

Fig.2. SEM image of the Ag deposits.

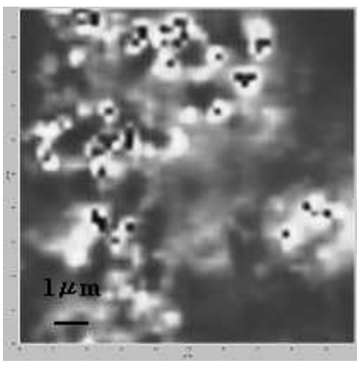

Fig.3. Representative image of the Raman mapping.