Fabrication of superhydrophobic gold microstructure on polymer substrates

Siriwan Boonmeewiriya¹, Supeera Nootchanat², Sanong Ekgasit², Kanet Wongravee²*

¹Program in Petrochemistry and Polymer Science, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand
²Sensor Research Unit, Department of Chemistry, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand
*E-mail: kanet.w@chula.ac.th

Abstract: Superhydrophobic surface has been used in the wide potential applications including textiles, medical instruments, etc. In this study, the superhydrophobic gold films were fabricated by reduction reaction between solution of sodium formate (HCOONa) and chloroauric acid (HAuCl₄) on several polymer substrates. The effects of surface tension of the substrates such as glass slide, acrylic, poly(methyl methacrylate) (PMMA) and polydimethylsiloxane (PDMS) on the hydrophobicity of the generated gold film were deeply investigated. Contact angle was measured by in-house goniometer and the aggregated gold microstructure was monitored by SEM. It was found that the superhydrophobic surface was created by porosity of the aggregated gold microparticles (AuMPs). The gold film on the substrate with lower critical surface tension (γc) provides the larger contract angle. In the case, the gold growth solution can be easily formed a drop on the surface with low γc. Therefore, the deposition of AgMPs on the substrate was dense and later formed porous structure. Water contract angle >150° was observed using these fabricated superhydrophobic gold films on the polymer substrates. Finally, the gold film was used as a powerful SERS substrate to pre-concentrate a target analyte before the detection and provide an enormous number of SERS hotspots.

Keywords: Surface tension; Superhydrophobic; Nanoparticles; Aggregation; Scanning electron microscope