CHAPTER V

CONCLUSIONS

Complex gold micro/nanostructures including coral-liked, needle-liked, Zen stone-liked gold nanostructures, and coral-liked gold micro/nanoporous film was synthesized by galvanic replacement reaction between a sacrificed silver metal and gold (III) ion (Au^{3+}) without stabilizer, capping agent. The complex structures could be controlled by tuning environmental conditions (*i.e.*, gold (III) ion condition, immersion time, chloride ion concentration, pH, and ultrasonic radiation). The coral-liked gold nanostructures with plate thinness size of 40-60 nm prefer grew on the gold film at 5,000 ppm of Au^{3+} solution, pH = 0, without excess Cl^-. But Needle-liked gold nanostructures with tips diameter of 20-50 nm grew with 2 M NaCl. In the case of Zen stone-liked gold microstructures size was controlled by pH of Au^{3+} solution. At pH 7, Zen stone-liked gold microstructures was developed on silver surface and absent the structures while increased pH of Au^{3+} solution to 14. The structural evolutions of coral-liked gold nanostructures were observed by scanning electron microscope (SEM) with energy dispersive X-ray spectroscope (EDS). The epitaxial growth of gold film on the surface of silver was interfered by the precipitated AgCl that case to Au/AgCl composites. Excess Cl^- was added into Au^{3+} solution that reacted with AgCl transforming to soluble $AgCl_2^-$. The soluble species play an important role on the evolution needle-liked gold nanostructures. The micro channels of AgCl layer was observed on coral-liked and needle-liked gold nanostructures that assisted to mass, Au^{3+}, Cl^-, and Ag^+, transform of the reaction. The ultrasonic also induced an auto-detachment of the galvanic generated film along the Au/AgCl interface. The complex gold nanostructures with nanoporous morphology were realized once the co-developed AgCl was removed. Coral-liked gold micro/nanoporous express high SERS detection up to 10^{-6} M rhodamine 6G (R6G) and crystal violet (CV).

All in all, the objectives of this research are fully fulfilled.