Jong-Guk Ahn
Younghee Park, Hyunseob Lim
Department of Chemistry, Chonnam National University (CNU), Gwangju 61186, Republic of Korea

Jongguk.ahn@gmail.com

Surface Enhanced Raman Spectroscopy at Nanogap between Au Nanoparticles Separated by 2D hexagonal Boron Nitride

The controlled formation of hot spot formed at nanogap between metal nanoparticles in surface enhanced Raman spectroscopy (SERS), since it can enhance the Raman signal of target molecule dramatically. Therefore, various methods have been attempted to produce the nanogap, and several approaches even enable the single molecule level detection by SERS. Nevertheless, the precise control of nanogap is not only technically difficult, but also the reproducibility is not good. In addition, the most of approaches is not appropriate to practical applications. Herein, we present a new approach to produce nanogaps between Au nanoparticles (Au NPs) separated with hexagonal boron nitride (h-BN) by making a Au NPs/h-BN/Au NPs heterostructure. In previous study, we have demonstrated that h-BN can be a good wrapping layer for SERS nanoparticle, which is used as a two-dimensional insulator material. The Au NPs/h-BN/Au NPs heterostructure can be manufactured by introducing additional Au NPs onto h-BN/Au NP substrate. The theoretical simulation has been carried out by using Finite-Difference Time-Domain (FDTD) method to visualize the electromagnetic field amplification at Au NPs/h-BN/Au NPs nanogap, which reveals that the stronger electromagnetic field can be generated at the nanogap structure of AuNP/h-BN/AuNPs. We believe that our results provide the critical insight for the nanogap based SERS applications by using the heterostructures of two-dimensional insulators and metal nanoparticles.

References

[1] Katrin Kneipp, *et al.* Phys. Rev. Lett., **78** (1997) 1667
[2] Jian-Feng Li, *et al.* Nature, **464** (2010) 392
[3] Gwangwoo Kim, *et al.* ACS Nano, **10** (2016) 11156

Figures

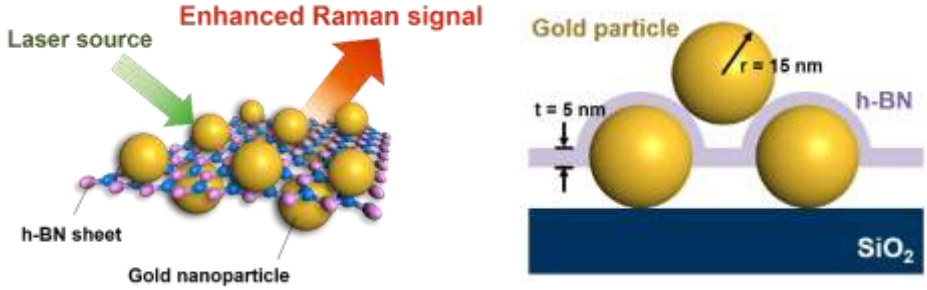

Figure 1. Schematic illustration of Au nanoparticles/h-BN/Au nanoparticles heterostructure

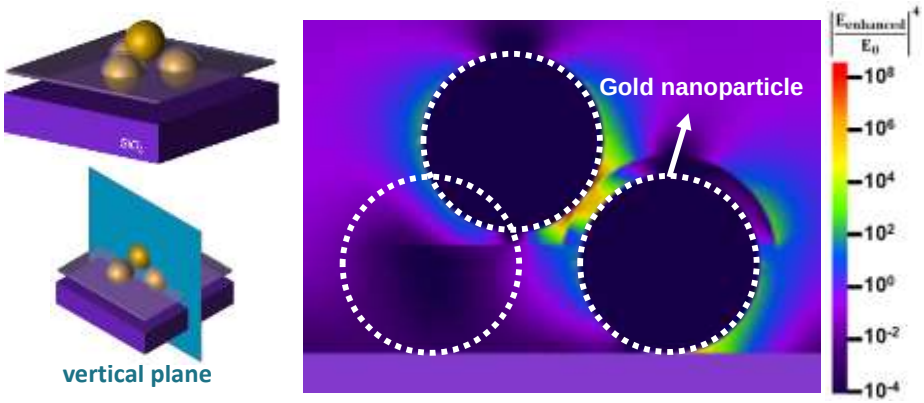

Figure 2. Finite-Difference Time-Domain simulation results of Au nanoparticles/ h-BN/Au nanoparticles structure.