Center for Molecular Spectroscopy and Dynamics, IBS-Korea University

IBS Center for Molecular Spectroscopy and Dynamics

Seminar

■ **SPEAKER**

Dr. Won-Hwa Park (KLA-Tencor)

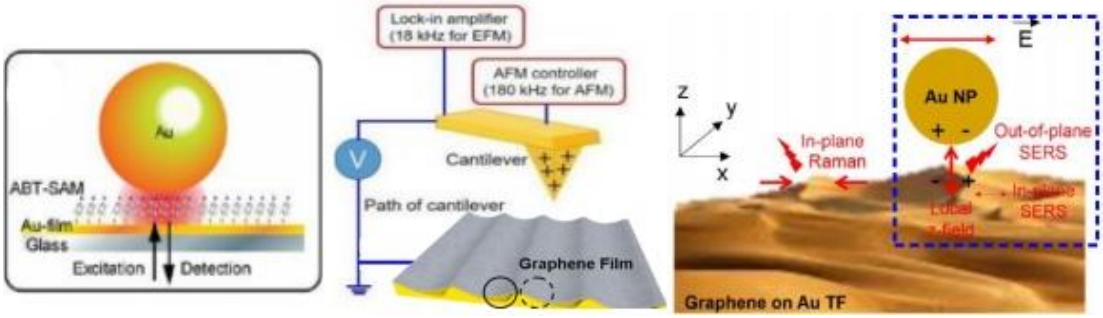
■ **TITLE**

Nanoscale Characterization of Various Functional Materials: Raman, Surface-Enhanced Raman Spectroscopy, and Electrostatic Force Microscopy Techniques

■ **ABSTRACT**

We report that self-assembled Au nanoparticle (NP)–molecular monolayer–Au thin film (TF) junctions (Nanoparticle-on-Mirror, NPoM) show a reproducibility Surface-Enhanced Raman Scattering (SERS) signal at the single junction level. (1) The SERS of individual NPoM was explored in terms of both electromagnetic (EM) and charge-transfer (CT) enhancement mechanisms [1]. Next, we develop appropriate characterization methods to achieve high-quality chemical vapor deposition of graphene monolayer (CVD-GM) electrodes. In this work, (2) Raman spectroscopy/microscopy is employed to unravel the contact effect between the CVD-GM and the underlying Cu substrate in suspended/supported formation considering the shape of the Cu substrate, with corroborative studies [2]. (3) The SERS system is also described, unveiling the presence of a z-directional radial breathing-like mode (RBLM) around 150 cm−1, which matches the Raman shift of the radial breathing mode (RBM) from single-walled carbon nanotubes (SWCNTs) around 150 cm−1. This result indicates the CVD-GM located between the Au NP and Au TF is not always flat but comprises heterogeneous protrusions of some domains along the z-axis thanks to generating the local z-polarization at the junction. Consequently, the degree of lateral carrier mobility of CVD-GM can be influenced, as the protruding domains result in lower lateral carrier mobility due to a higher flexural phonon–electron scattering effect after transfer [3]. (4) To reduce the number of ripples (RP), a plausible fabrication can be developed that controls the electrical properties of the CVD-GM by tuning the cooling rate. Moreover, we can figure out the shape of RPs on CVD-GM can also affect the electrical performance considering the structural stability via Raman spectroscopy results [4]. (5) In addition, the CT effect from the sandwiched CVD-GM in NPoM can be also examined and the anti-correlation phenomenon between edge and flat junction

can be revealed as EM (2D enhancement) and CT (RBLM enhancement) influences, respectively, by loading Au prism [5]. (6) Electrostatic force microscopy (EFM) is used for the measurement of the relative surface charge distribution of CVD-GM at the nanoscale and is crucial in assessing the electrical performance of the CVD-GM. As such, the contact effect between CVD-GM and polyethylene terephthalate (PET) substrate and the resultant local electrical performance of the CVD-GM can be quantitatively evaluated and anticipated for new electrical nano-metrology [6].



[1] W.-H. Park and Z.H. Kim*, Nano. Lett. (2010) 10, 4040

[2] W.-H. Park* et al, *PCCP* (2014) 16, 26385

[3] W.-H. Park*, *J. Phys. Chem. C*. (2014) 118, 6989

[4] W.-H. Park* et al., *Nanoscale* (2016) 8, 9822

[5] W.-H. Park* et al., *J. Phys. Chem. C.* (2016) 479, 874

[6] W.-H. Park* et al, *Appl. Phys. Lett,* (2013), 103, 033107

■ **DATE AND VENUE**

Dec 14, 2022 (Wednesday, 11:00 a.m. -12:00 p.m.)

Zoom

■ **LANGUAGE**

Korean

■ **INVITED BY**

Director Minhaeng Cho