Center for Artificial Low D Electronic Systems

2018 IBS-CALDES Special seminar

- ✓ **Date & Time : Monday, July 30th at 4PM**
- ✓ **Venue : Seminar Room #201, Science building #3**
- ✓ **Speaker : Prof. Michael C. Tringides(Iowa State University)**
- ✓ **Title & Abstract : "Metal growth on and under graphene"**

Graphene based electronic and spintronic devices require understanding the growth of metals on graphene. Several metals (Gd, Dy, Eu, Fe,Pb) deposited on epitaxial graphene were studied with STM, SPA-LEED and DFT. For practically all metals the growth mode is 3-d[1,2].This is a result of the low ratio of the metal adsorption to metal cohesive energy and repulsive interactions between unscreened charges at the metal-graphene interface that favor islands of small "footprint". It is an open challenge to find ways to modify the growth to layer–by–layer for high quality metal contacts and graphene applications as a spin filter. By growing Dy at low temperatures or high flux rates it is found that upward adatom transfer is kinetically suppressed and layer-by-layer is possible[3]. These results are also relevant for metal growth on other 2-d van der Vaals materials that also have weak bonding with metals and favor 3-d metal growth.

The graphene-metal interaction is also important for metal intercalation which provides a novel way to tune graphene's properties, besides doping. Many issues related to the intercalation process itself are poorly understood, i.e., the temperature and entry points where atoms move below graphene, different intercalation phases, their coverage, etc. SPA-LEED and STM were used to study these questions for Dy and Pb intercalation. Spot profiles of several spots (specular, 6sq(3), graphene) are studied as function of temperature and electron energy to deduce the kinetics of intercalation and the layer where the intercalated atoms reside. Intercalated layers of high Z metals can be realizations of 2-d topological materials, especially when the intercalated metal phases can be tuned selectively.

Dy nucleation experiments were performed on graphene partially intercalated with Dy. The results show that nucleation is preferred on the intercalated than on the pristine areas. Difference in doping between the two areas generates an electric field that transforms random walk to directional diffusion and accounts for the guided nucleation[4]. This can be a general method to control patterning of metallic films on graphene.

References

1.M. Hupalo et al Advanc. Mater. 23 2082 (2011) 2.X. Liu, et al. Progr. Surf. Sci. 90 397 (2015) 3. D. Mc Dougall et al Carbon 108 283 (2016)) 4. X. Liu et al. Nano Research 9(5): 1434 (2016)

- ✓ **Organized by Prof. Han Woong Yeom (yeom@postech.ac.kr_054-279-2091)**