IBS Center for Multidimensional Carbon Materials

Special Guest Seminar

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TEM Studies on Emergent Interface Phenomena

JAN 17
WED 3 PM

Bldg. 101
Seminar Room on the 1st floor

Engineered interfaces can be endowed with the emergent properties which do not exist in its parent materials and hence promise the realization of new functionalities. I will present some of my research programs in which advanced TEM techniques, such as electron holography, in-situ TEM and atomic-resolution STEM are used to elucidate emergent interface phenomena.

In the first topic, taking an example of two-dimensional electron gases (2DEGs) forming at $LaAlO_3/SrTiO_3$ interfaces with different crystal symmetry, I will show that the selective orbital occupation and spatial quantum confinement of 2DEGs can be resolved with sub-nm resolution using inline electron holography. For the standard (001) interface, the charge density map obtained by inline electron holography shows that the 2DEG is confined to the interface with narrow spatial extension (~1.0 ± 0.3 nm in the half width). On the other hand, the 2DEG formed at the (111) interface shows a much broader spatial extension (~3.3 ± 0.3 nm) with the maximum density located ~2.4 nm away from the interface, in excellent agreement with density functional theory calculations [1].

In the second topic, I will show the in-situ atomic scale observation on Cu-graphene interface and its dynamic evolution during the growth of graphene layers. Under multilayer graphene the stepped Cu (111) surface shows distinct multilayer relaxation and layer-by-layer surface melting initiating at the step [2]. Finally, I will discuss a role of phonon coupling between the flexural ZA phonon mode of graphene and the surface Rayleigh waves of Cu substrate and its consequence on the dynamic motions of the interface.

References:
[1] Kyung Song, et al., *in press in Nature Nanotechnolgy* (2018).
[2] Sang Ho Oh, et al., *in preparation* (2017).

You are cordially invited to attend!