

IW-001

Characterization and surface engineering of two-dimensional atomic crystals

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The next generation electronics need to not only be smaller but also be more flexible. To meet such demands, van der Waals (vdW) heterostructures using two dimensional (2D) atomic crystals such as graphene, hexagonal boron nitride (h-BN) and transition metal dichalcogenides (TMDCs) have been attracted intensely. In particular, for high performance of vdW heterostructures device, ultraclean interface between stacked 2D atomic crystals should be guaranteed. In this talk, I will present fabrication and characterization of the vdW field effect transistors toward performance enhancement by employing TMDCs channel, h-BN insulating layer and graphene electrode. Furthermore, it will also be introduced the characterization and surface engineering of graphene for gas molecule sensor.

Keywords: graphene, hexagonal boron nitride (h-BN) and transition metal dichalcogenides (TMDCs)

IW-002

Switching and sensing molecular spins by chemical reactions on metal surfaces

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Controlling and sensing spin states of magnetic molecules such as metallo-porphyrins at the single molecule level is essential for spintronic molecular device applications. Axial coordinations of diatomic molecules to metallo-porphyrins also play key roles in dynamic processes of biological functions such as blood pressure control and immune response. However, probing such reactions at the single molecule level to understand their physical mechanisms has been rarely performed. Here we present on our single molecule association and dissociation experiments between diatomic and metallo-porphyrin molecules on Au(111) describing its adsorption structures, spin states, and dissociation mechanisms. We observed bright ring shapes in NO adsorbed metallo-porphyrin complexes and explained them by considering tilted binding and precession motion of NO. Before NO exposure, Co-porphyrin showed a clear zero-bias peak in scanning tunneling spectroscopy, a signature of Kondo effect in STS, whereas after NO exposures it formed a molecular complex, NO-Co-porphyrin, that did not show any zero-bias feature implying that the Kondo effect was switched off by binding of NO. Under tunneling junctions of scanning tunneling microscope, both positive and negative energy pulses. From the observed power law relations between dissociation rate and tunneling current, we argue that the dissociations were inelastically induced with molecular orbital resonances. Our study shows that single molecule association and dissociation can be used to probe spin states and reaction mechanisms in a variety of axial coordination between small molecules and metallo-porphyrins.

Keywords: Scanning tunneling microscopy, single spin, reaction