S-005

The Influence of Hydrogen Intercalation on the Nanomechanical Properties of Epitaxial Graphene on SiC Substrates

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Atomically-thin graphene is the ideal model system for studying nanoscale friction due to its intrinsic two-dimensional anisotropy. Here, we report the reduced nanoscale friction of epitaxial graphene on SiC, investigated with conductive-probe atomic force microscopy/friction force microscopy in ultra-high vacuum. The measured friction on a buffer layer was found to be 1/8 of that on a monolayer of epitaxial graphene. Conductive probe atomic force microscopy revealed a lower conductance on the buffer layer, compared to monolayer graphene. We associate this difference in friction with the difference in total lateral stiffness. Because bending stiffness is associated with flexural phonons in two-dimensional systems, nanoscale frictional energy should primarily dissipate through damping with the softest phonons. We investigated the influence of hydrogen intercalation on the nanoscale friction. We found that the friction decreased significantly after hydrogen intercalation, which is related to loose contact between the graphene and the substrate that results in a lower bending stiffness.

Keywords: Friction, SiC, Epitaxial, Graphene

S-006

Sequential Formation of Multiple Gap States by Interfacial Reaction between Alq3 and Alkaline-earth Metal

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Electron injection enhancement at OLED (organic light-emitting diodes) cathode side has mostly been achieved by insertion of a low work function layer between metal electrode and emissive layer. We investigated the interfacial chemical reactions and electronic structures of alkaline-earth metal (Ca, Ba)/Alq3 [tris(8-hydroxyquinolinato)aluminium] and Ca/BaF2/Alq3 using in-situ X-ray & ultraviolet photoelectron spectroscopy. The alkaline-earth metal deposited on Alq3 generates two energetically separated gap states in sequential manner. This phenomenon is explained by step-by-step charge transfer from alkali-earth metal to the lowest unoccupied molecular orbital (LUMO) states of Alq3, forming new occupied states below Fermi level. The BaF2 interlayer initially prevents from direct contact between Alq3 and reactive Ca metal, but it is dissociated into Ba and CaF2. However, as the Ca thickness increases, the Ca penetrates the interlayer to directly participate in the reaction with underlying Alq3. The influence of the multiple gap state formation by the interfacial chemical reaction on the OLED performance will be discussed.F

Keywords: Mutiple Gap states, Alkali-earth metal, Alq3, UPS, XPS