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Fabrication of graphene field-effect transistor on top of ferroelectric single-crystal substrate NAHEE PARK, HAEYONG KANG, YOURACK LEE, JEONG-GYUN KIM, JOONG-GYU KIM, YOOJOO YUN, JEONGMIN PARK, TAESOO KIM, JUNG HO KIM, YOUNGJO JIN, YONG SEON SHIN, YOUNG HEE LEE, DONGSEOK SUH, Center for Integrated Nanostructure Physics (CINAP/IBS) and Dept. of Energy Science (DOES), Sungkyunkwan University — In the analysis of Graphene field-effect transistor, the substrate material which has the direct contact with Graphene layer plays an important in the device performance. In this presentation, we have tested PMN-PT(i.e.(1-x)Pb(Mg_{1/3}Nb_{2/3})O₃-xPbTiO₃) substrate as a gate dielectric of Graphene field-effect transistor. Unlike the case of previously used substrates such as silicon oxide or hexagonal Boron-Nitride(h-BN), the PMN-PT substrate can induce giant amount of surface charge that is directly injected to the attached Graphene layer due to its ferroelectric property. And the hysteresis of polarization versus electric field of PMN-PT can cause the device to show the ferroelectric nonvolatile memory operation. We had successfully fabricated Graphene field-effect transistor using the mechanically exfoliated Graphene layer transferred on the PMN-PT(001) substrate. Unlike the case of mechanical exfoliation on the surface of silicon-oxide or the Poly(methyl methacrylate) (PMMA), the weak adhesion properties between graphene and PMNPT required the pretreatment on PMMA before the exfoliation process. The device performance is analyzed in terms of the effect of ferro- and piezo-electric effect of PMNPT substrate.

Nahee Park
Center for Integrated Nanostructure Physics (CINAP/IBS) and
Dept. of Energy Science (DOES), Sungkyunkwan University

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