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Graphene barristor for high performance devices

JINSEONG HEO, Samsung Advanced Institute of Technology

Graphene has unique properties, such as work-function tunability and high intrinsic mobility. Recently, we have introduced a new concept device, a graphene variable-barrier “barristor” (GB), based on those properties. In this presentation, I will describe the three-terminal active device, GB, where the key is an atomically sharp interface between graphene and hydrogenated silicon surface. Large modulation on the device current, on/off ratio of 100000, is achieved by adjusting the gate voltage to control the Schottky barrier between graphene and silicon. The barrier height was tuned to 0.2 electron volts by adjusting graphene work function which results in large shifts of diode threshold voltages. For logic application, an inverter and a half-adder were demonstrated using the complementary GB’s on 150-mm wafers. In addition, recently developed vertical transistor based on asymmetric junctions will be discussed.