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Dielectric Behavior of 2D Layered Insulator Hexagonal Boron Nitride

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Abstract : Hexagonal boron nitride (h-BN) has been used as a substrate and gate dielectric for graphene field effect transistors (GFETs). Using a graphene/h-BN/TiN (channel/dielectric/gate) stack, key material properties of h-BN were investigated i.e. dielectric strength and tunneling behavior. Work function difference between graphene and TiN results in spontaneous p-doping of graphene through a multi-layer h-BN flake. However, at high levels of current stress, n-doping of graphene is observed, possibly due to the charge transfer across the thin h-BN multi layer. Neither Direct Tunneling (DT) nor Fowler-Nordheim Tunneling (FNT) was observed in TiN/h-BN/Au hetero structures with h-BN showing two distinct volatile conduction states before breakdown. Hexagonal boron nitride emerges as a material of choice for gate dielectrics in GFETs because of robust dielectric properties and high tunneling barrier.

Keywords : graphene, transistors, conduction, hexagonal boron nitride, dielectric strength, tunneling
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