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Two-Dimensional Nanostack Based On Chip Wiring

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Abstract : The material behavior of graphene, a single layer of carbon lattice, is extremely sensitive to its dielectric environment. We demonstrate improvement in electronic performance of graphene nanowire interconnects with full encapsulation by lattice-matching, chemically inert, 2D layered insulator hexagonal boron nitride (h-BN). A novel layer-based transfer technique is developed to construct the h-BN/MLG/h-BN heterostructures. The encapsulated graphene wires are characterized and compared with that on SiO2 or h-BN substrate without passivating h-BN layer. Significant improvements in maximum current-carrying density, breakdown threshold, and power density in encapsulated graphene wires are observed. These critical improvements are achieved without compromising the carrier transport characteristics in graphene. Furthermore, graphene wires exhibit electrical behavior less insensitive to ambient conditions, as compared with the non-passivated ones. Overall, h-BN/graphene/h-BN heterostructure presents a robust material platform towards the implementation of high-speed carbon-based interconnects.

Keywords : two-dimensional nanosheet, graphene, hexagonal boron nitride, heterostructure, interconnects
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