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A three-dimensional architecture of vertically aligned multilayer graphene facilitates heat dissipation across joint solid surfaces QIZHEN LIANG, XUXIA YAO, WEI WANG, C.P. WONG, Georgia Institute of Technology — Low operation temperature and efficient heat dissipation are important for device life and speed in current electronic and photonic technologies. Being ultra-high thermally conductive, graphene is a promising material candidate for heat dissipation improvement in devices. In the application, graphene is expected to be vertically stacked between contact solid surfaces in order to facilitate efficient heat dissipation and reduced interfacial thermal resistance across contact solid surfaces. However, as an ultra-thin membrane-like material, graphene is susceptible to Van der Waals forces and usually tends to be recumbent on substrates. Thereby, direct growth of vertically aligned free-standing graphene on solid substrates in large scale is difficult and rarely available in current studies, bringing significant barriers in graphene's application as thermal conductive media between joint solid surfaces. In this work, a three-dimensional vertically aligned multi-layer graphene architecture is constructed between contacted Silicon/Silicon surfaces with pure Indium as a metallic medium. Significantly higher equivalent thermal conductivity and lower contact thermal resistance of vertically aligned multilayer graphene are obtained, compared with those of their recumbent counterpart. This finding provides knowledge of vertically aligned graphene architectures, which may not only facilitate current demanding thermal management but also promote graphene's widespread applications such as electrodes for energy storage devices, polymeric anisotropic conductive adhesives, etc.

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