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Preparation and anisotropy of large-scale lyotropically aligned functionalized multilayer graphene QIZHEN LIANG, XUXIA YAO, WEI WANG, C.P. WONG, Georgia Institute of Technology — Comparing with ballistic electron and phonon transport along graphene sheets, phonon and electron transferring traversing stacked graphene layers are conducted by weak Van der Waals forces and hopping conduction so that inevitably debate mechanical, electrical and thermal properties in "out-of-plane" direction. Alignment of graphene sheets can orient covalent chemical bonds in these parallel planes, resulting in a strong anisotropy of the large-scale materials from various graphitic forms with optimized mechanical, electrical and thermal properties. Moreover, systematic characterizations of the anisotropy of the ordered structures are rarely available due to their low profile in thickness directions. Here, conductors with highly ordered lamellar structure in large scale are prepared at room temperature from functionalized multilayer graphene (fMGs) by a lyotropical alignment methodology. Distinct difference in mechanical, electronic and thermal properties between lateral (in-plane) and thickness (out-of-plane) directions of the aligned fMGs indicates a strong anisotropy. Benefiting from the anisotropy, ultrahigh electrical and thermal conductivities in lateral direction are obtained, without aid of any chemical or thermal reduction. The finding facilitates the potential large-scale preparation and application of multilayer graphenes in photonic and electronic components, electrodes for energy collectors, conductive polymeric adhesives and composites.

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