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Directed Nanoscale Assembly of Graphene Based Materials

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Graphene based materials, including fullerene, carbon nanotubes and graphene, are two-dimensional polymeric materials consisting of sp² hybrid carbons. Those carbon materials have attracted enormous research attention for their outstanding material properties along with molecular scale dimension. The optimized utilization of those materials in various application fields inevitably requires the subtle controllability of their structures and properties. In this presentation, our research achievements associated to directed nanoscale assembly of B- or N-doped graphene based materials will be introduced. Graphene based materials can be efficiently processed into various three-dimensional structures *via* self-assembly principles. Those carbon assembled structures with extremely large surface and high electro-conductivity are potentially useful for energy and environmental applications. Aqueous dispersion of graphene oxide shows liquid crystalline phase, whose spontaneous molecular ordering is useful for display or fiber spinning. Along with the structure control by directed nanoscale assembly, substitutional doping of graphene based materials with B- or N- can be attained *via* various chemical treatment methods. The resultant chemically modified carbon materials with tunable workfunction, charge carrier density and enhanced surface activity could be employed for various nanomaterials and nanodevices for improved functionalities and performances.