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Processing of pristine graphene dispersions, gels, and composites FAHMIDA IRIN, SRIYA DAS, Texas Tech University, DORSA PARVIZ, MICAH GREEN, Texas A&M University — This work focuses on the central concept of producing graphene from graphite without covalently functionalizing the graphene basal plane; such graphene may be stabilized, dispersed, and processed for use in a range of high-performance materials. In particular, we show that various dispersants such as triphenylene derivatives, polymers (polyvinylpyrrolidone), pyrene derivatives etc. can naturally absorb to the graphene surface, create repulsive (steric and electrostatic) forces, and prevent aggregation. This allows for graphene dispersion in a wide range of organic solvents and composite precursors without compromising graphene structure. Such dispersions are stable against aggregation even when subjected to extreme temperature changes, pH changes, and freeze drying. The applications of these dispersions include the production of graphene/polymer nanocomposites, synthesis of self-healing hydrogels, and electrically conductive aerogels. We fabricate graphene loaded polyvinyl alcohol (PVA) films which show enhanced modulus, strength, and electrical conductivity. We also demonstrate novel results in the area of creating graphene loaded self-healing hydrogels. The hydrogels can be converted into electrically conductive aerogels that can be utilized as a template for doubly-percolated polymer composites.

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