

Electrical conductivity of graphene/polymer composites prepared by freeze drying

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Despite a great deal of intention in recent years, the conventional prep methods of polymer/graphene nanocomposites have serious limitations in dispersing the graphene nanosheets in a polymer matrix. Graphene nanosheets are often aggregated in polymer matrix making the multifunctional ability of graphene weaken. Herein, we have developed a method to prepare polymer composites with well-dispersed graphene through directional crystallization and freeze drying. In this preparation, the membrane was fabricated by the directional crystallization of solvent in the homogenous mixtures of polymer and graphene sheets. Driven by the growing solvent crystals, the graphene nanosheets produced a well-aligned structure along with polymer walls. This crystallization process can effectively freeze the solution dispersion state of graphene and form a macroscopically aligned network of graphene nanosheets. Subsequent hot pressing could prepare composite films having graphene sheets closely connected, which contributes to the improved thermal, mechanical and electrical properties. This approach of producing graphene-polymer composites provides a novel path to prepare key materials for future applications.