

## Exfoliation of Functionalized High Structural Integrity Graphene Nanoplatelets at Extremely Low Temperature

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**Abstract :** Because of its exceptional properties, graphene has become the most promising nanomaterial for the development of a new generation of advanced materials from battery electrodes to structural composites. However, current methods to meet requirements for the mass production of high-quality graphene are limited by harsh oxidation, high temperatures, and tedious processing steps. To extend the scope of the bulk production of graphene, herein, a facile, reproducible and cost-effective approach has been developed. This involved heating a specific mixture of chemical materials at an extremely low temperature (70 °C) for a short period (7 minutes) to exfoliate functionalized graphene platelets with high structural integrity. The obtained graphene platelets have an average thickness of  $3.86 \pm 0.71$  nm and a lateral size less than  $\sim 2$   $\mu\text{m}$  with a low defect intensity ID/IG  $\sim 0.06$ . The thin film ( $\sim 2$   $\mu\text{m}$  thick) exhibited a low surface resistance of  $\sim 0.63$   $\Omega/\text{sq}^{-1}$ , confirming its high electrical conductivity. Additionally, these nanoplatelets were decorated with polar functional groups (epoxy and carboxyl groups), thus have the potential to toughen and provide multifunctional polymer nanocomposites. Moreover, such a simple method can be further exploited for the novel exfoliation of other layered two-dimensional materials such as MXenes.

**Keywords :** functionalized graphene nanoplatelets, high structural integrity graphene, low temperature exfoliation of graphene, functional graphene platelets

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