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Recent advances of the graphite exfoliation processes and structural modification of graphene: a review

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**Abstract:**
Graphene, which is made up of single-layer sp2 graphite, has stimulated the interest of researchers in a variety of application fields, including electronics, pharmaceuticals, and chemicals, due to its superior properties. Large-scale production of graphene is essential for the material to be viable and widely used. One of the most efficient methods of accomplishing a huge amount at a reasonable cost is to exfoliate graphite to produce graphene. The purpose of this paper is to analyze several exfoliation procedures based on a common mechanical and chemical mechanism, because a detailed analysis of the exfoliation phenomenon can lead to valuable insights about how to generate high-quality graphene more economically by optimizing exfoliation approaches. In this study, the focus is given on the extensively employed mechanical exfoliation, such as micromechanical cleavage method, sonication method, ball milling method, and fluid mechanics method and chemical exfoliation, such as chemical vapor deposition and chemical method. This study will also focus on the chemical functionalization of graphene, such as covalent functionalization and non-covalent functionalization. This review will give a deep knowledge about graphite exfoliation and functionalization phenomenon, which will guide in the right way for commercial bulk graphene synthesis with less defects.