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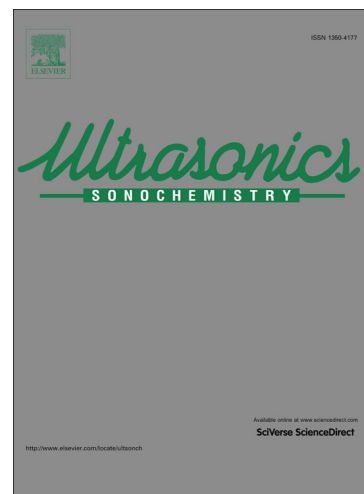
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Investigation of Tip Sonication Effects on Structural Quality of Graphene Nanoplatelets (GNPs) for Superior Solvent Dispersion

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Abstract

The exceptional properties of graphene and its structural uniqueness can improve the performance of nanocomposites if it can attain the uniform dispersion. Tip sonication assisted graphene solvent dispersion has been emerged as an efficient approach but it can cause significant degradation of graphene structure. This study aimed to evaluate the parametric influence of tip sonication on the characteristics of sp^2 carbon structure in graphene nanoplatelets by varying the sonication time and respective energy at three different amplitudes (60%, 80% and 100%). The study is essential to identify appropriate parameters so as to achieve high-quality and defect-free graphene with a highly desirable aspect ratio after solvent dispersion for composite reinforcement. Quantitative approach via Raman spectroscopy is used to find the defect ratio and lateral size of graphene evolved under the effect of tip sonication parameters. Results imply that the defect ratio is steady and increases continually with GNPs, along with the transformation to the nano-crystalline stage I up to 60 min sonication at all amplitudes. Exfoliation was clearly observed at all amplitudes together with sheet re-stacking due to considerable size reduction of sheets with large quantity. Finally, considerable GNPs fragmentation occurred during sonication with increased amplitude and time as confirmed by the reduction of sp^2 domain (L_a) and flake size. This also validates the formation of edge-type defect

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