Marriage of Graphene and Cellulose for Reinforced Composite Preparation

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Abstract

The synthesis and utilization of graphene have received considerable attention among the scientific community, with a progressive viewpoint on graphene as an ideal candidate for fillers in composites. However, some drawbacks and limitations have emerged in utilizing graphene for composite processing. The methods that thus far employed usually produce non-dispersible graphene in aqueous solution or organic solvent since graphene is hydrophobic in nature. Owing to this regards, electrochemical exfoliation technique with the assistant of surfactant was employed in this study thus preventing these drawbacks with aimed to produce stable and homogenous graphene suspension. The technique also allows a direct assembly of graphene for composite preparation via solvent intercalation and significantly overcome graphene indispersibility issue. Cellulose, being the potential marriage candidate for the composite matrix in this study is underpinned by its widespread capability as a natural and ubiquitous polymer while receiving much research interest by the scientific community. By taking advantage of reusing wastepaper, we provide a recycling alternative for cellulose material processing, wastematerial conversion and the production of the composites. Transmission electron microscopy (TEM) images showed a relatively transparent, thin and crumpled-silk like structure of graphene. Structural analysis of the cellulose were investigated by ATR-FTIR and X-ray diffraction. TEM and scanning electron microscopy analysis were both carried out for imaging analysis of graphene-cellulose composite. The presence of graphene as reincorporating agent and their marriage chemistry and possible mechanistic interaction of graphene-cellulose was significantly investigated in this project. The reinforcing ability of graphene-cellulose in the polymer composite was reflected through the improvement in the tensile strength. The mechanistic interaction of graphene-cellulose composite is conceptualized by Lindman effect behavior of cellulose and through amphiphilic capacity of sodium dodecyl sulphate as a surfactant.

References

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Figures