Highly Elastic Graphene/Polylactide/Epoxidized-palm-oil nanocomposite

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Abstract In this work, a new process for Graphene/Polylactide (PLA)/Epoxidized-palm-oil (EPO) nanocomposite production is developed by melt-blending of electrolyticcally exfoliated graphene with PLA/EPO polymer to improve to PLA/EPO's elastic properties. Graphene was synthesized by electrolytic exfoliation of graphite in a polyelectrolyte solution. From scanning and transmission electron microscopy, polygonal graphene sheets are observed with dimensions in the range of few-hundred nanometers. Raman spectra demonstrate typical D, G and 2D peaks of multilayer graphene at ~1356, ~1587 and ~2600 cm^{-1}, respectively. In addition, graphene causes a small peak shift at 2Θ = 17.5O in x-ray diffraction patterns of the composites, indicating interaction between graphene and PLA/EPO network but graphene peak cannot be observed with increasing graphene content up to 0.8 wt%. The results indicate that the graphene are homogenously dispersed in the PLA matrix without aggregation. Mechanical properties of PLA and composites were evaluated by tensile test on specimens prepared based on ASTM D638 standard. The results show that loading of electrolytically exfoliated graphene in PLA/EPO at an optimal concentration of 0.6wt% results in higher elongation at break by as much as 52%. Thus, the developed graphene/PLA/EPO nanocomposite is a promising material for mechanical applications such as food packaging.

References

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Figures

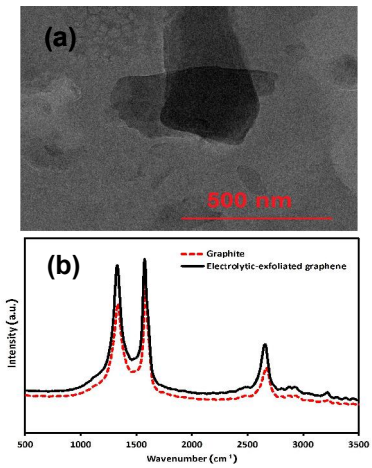

Figure. 1 TEM image (a) and Raman spectrum (b) of electrolytic exfoliation graphene powder

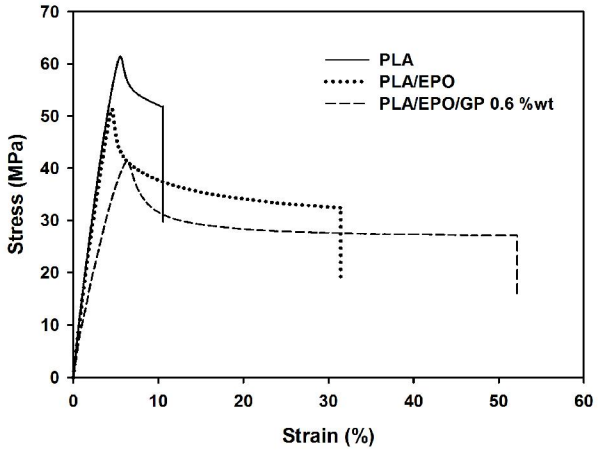

Figure. 2 Stress-stain curves of PLA, PLA/EPO and PLA/EPO/GP composites with 0.6wt% graphene content.