Graphene Nanocomposites for High-Barrier Applications

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Abstract
An important function of food packaging is to preserve the food from spoilage. Oxygen is a key reactant in the spoilage of food and so its exclusion is a major factor in increasing the food's shelf-life. In order to maintain the integrity of the inert atmosphere the food is packaged under, it is essential that the packaging material present a high barrier to oxygen diffusion. A common strategy to increase this barrier in polymeric packaging is the inclusion of flakey, nanoscale fillers. The resulting nanocomposites are expected to show an increased barrier due to the increased tortuosity of the diffusion path the oxygen must follow while going around the filler particles [1]. The graphene family of materials may provide an optimum filler for this application, while also adding other functionality to the material, such as increased electrical and thermal conductivity [2]. In this study, pristine graphene, graphene oxide, and reduced graphene oxide from exfoliated natural graphite are melt processed with polyethylene and extruded into a film (see Figure 1). The mechanical properties of the film are measured, including permeability, tensile, and rheological properties. In order to correlate the observed mechanical properties with the state of the graphene materials in the nanocomposite, the materials are further characterized by physicochemical techniques, including Raman, electron microscopy, and x-ray scattering.

References
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[2] H. Kim, A.A. Abdala, and C.W. Macosko, Macromolecules **43** (2010) 6515.

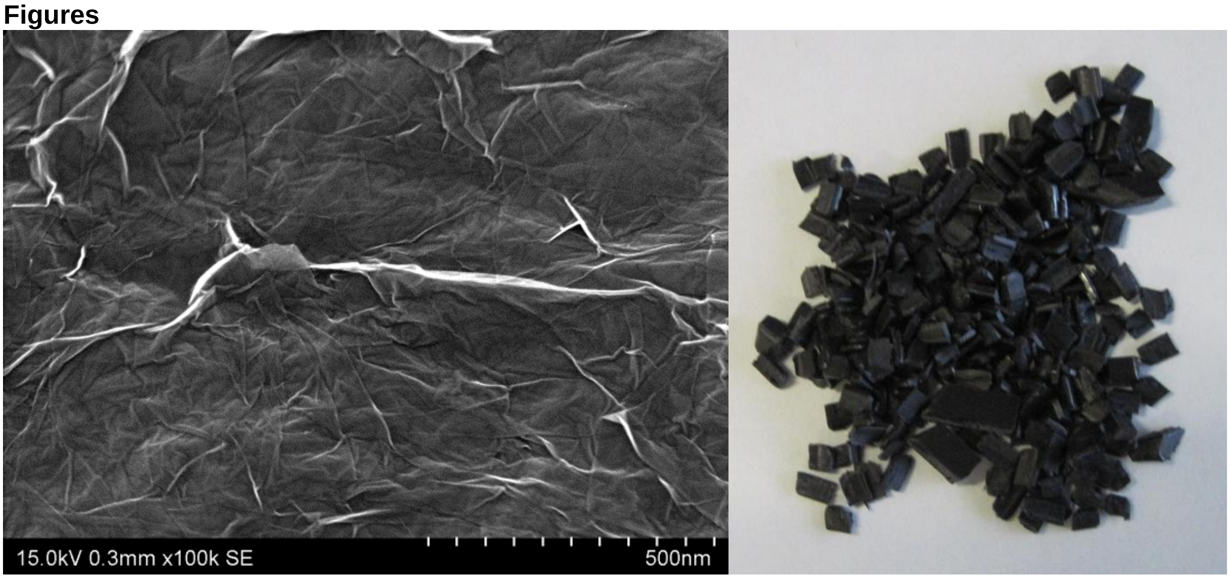
Figures


Figure 1. (Left) SEM image of the reduced graphene oxide. (Right) Photograph of the reduced graphene oxide / polyethylene compounded pellets.