**Scalable fabrication of thermally conductive flexible diethyl glycol modified graphene oxide polymer films**

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Abstract

Polymer nanocomposites have been extensively used in industries, especially in electronic industry as thermal interface materials (TIMs) and thermal management materials, due to their characteristics properties related with electrical and thermal conductivity (TC)[[1](#_ENREF_1),[2](#_ENREF_2)]. Modern electronics are subjected to extreme overheating, necessitating the development of novel methods for creating scalable TIMs with high thermal conductivity. The problem of electronic device failure brought on by the high heat generation demands the creation of effective TIMs that can disperse thermal energies rapidly, especially for cellular devices and computers. Therefore, it is extremely important and necessary to develop substrates that provide the advantages of high thermal conductivity as well as reduced thickness in order to ensure enhanced thermal performances, flexibilty, lifetime, and reliability. Papery films with characteristics including simple facile processing, optimum thickness, and improved flexibility are emerging as a new class of materials for thermal management applications in electronics[[1](#_ENREF_1)].

Graphene, hexagonally organized sp2-bonded carbon atoms, has attracted significant interest in the realm of effective heat management materials due to its extreme high in-plane TC of ~ 5000 W/mK[[3](#_ENREF_3)]. In this study, fillers made of graphene oxide (GO) are employed to increase the polymer’s TC. However, it is susceptible to aggregation due to weak interfacial bonding between pure graphene and hydrophilic Poly vinyl alcohol (PVA) polymer matrix with high van der Waals pressures between graphene sheets. It has been shown that surface modification of materials, such as graphene-based materials, is an effective technique to increase the dispersibility and affinity with organic polymers which benefits from increasing the composites' thermal conductivity. Hence, in our work , we surface grafted GO with diethyl glycol (DEG) via hydrothermal method resuting in the reduction of GO and consequently, dispersing them homogeneously in PVA matrix. The as fabricated DEG-GO/PVA film via facile casting method depicted good thermal conductivity and electrical conductivity in contrast to pristine GO/PVA films.

**Keywords:** Thermal conductivity, electrical resistivity, graphene oxide, diethylene glycol, poly vinyl alcohol

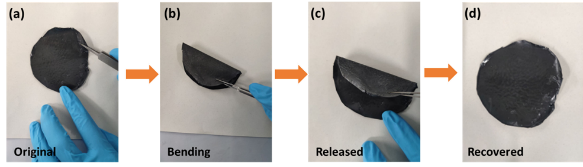


Figure 1. Flexibility of thermaly conductive DEG-GO/PVA films

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