Synthesis of composite materials using silane-functionalized graphene oxide and their Applications

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We provide a new method for composites such as Carbon Fiber Reinforced Plastic (CFRP) and Organic Photovoltaic cells (OPVs) by using Silane-functionalized graphene oxides (sGOs). sGOs were fabricated with four different self-assembled monolayers (SAMs). The functionalization of the oxygen-containing groups on the surface of GO were converted by the SAMs to amine, epoxy, and alkyl groups. The formation of Si-O-C, Si-O-Si, and Si-H bonds, the higher decomposition temperature, the change of diffraction angle, and the appearance of Si peak indicated that the reaction between silane molecules of SAMs and functional groups of GO occurred successfully. In case of CFRP based sGOs were fabricated to reinforce an epoxy adhesive, with the aim of improving the bonding strength of carbon/epoxy composites. The bonding strength of a carbon fiber/epoxy composite, tested with a single lap joint bonded with an epoxy adhesive, was increased by 53% after the addition of a sGO that contained amine groups. Therefore, it is thought that sGOs could be used in adhesive bonding applications to increase the bonding strength. Another case of OPVs based sGO (GPTMS, MTES), the power conversion efficiency (PCE) value increase to 3.00 and 3.08 %, respectively. SPRES data shows that the work function of GO, GPTMS-sGO, and MTES-sGO were 4.8, 4.9, and 5.0 eV, respectively. Therefore, it is considered that the increase in the PCE value is caused by the bandgap alignment. It is thought that the use of sGO could improve the performance of OPVs.

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Figures

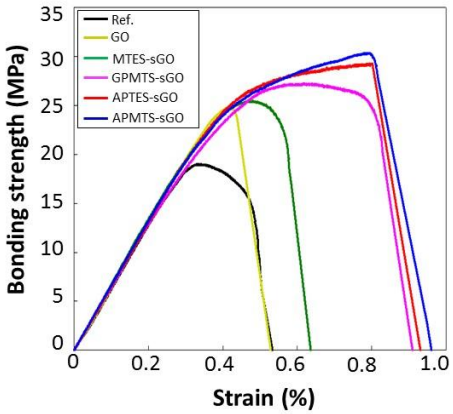

Figure 1: Representative bonding strength-strain relationships after the addition of GO or the sGOs into the carbon fiber/epoxy composite single lap joints.