Fabricating Conductive Polymer Systems with Graphene Oxide for Anti-Static Coatings

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Photocurable Conductive Films

Energy conversion
- Solar cell
- Fuel cell

Energy storage
- Supercapacitors
- Li-ion batteries

Chemical screening
- Gas barrier
- Electrolyte barrier

Graphene derivatives

Electronic materials
- Flexible electrodes
- Conductive ink
- Transistors
- Antistatic coatings

Low density structural materials
- Protective coatings
- Robust substrate

Sensors
- Photodetector
- Florescence bleaching

Photocurable films made with graphene oxide can enhance the electrical and mechanical properties

The resistance of graphene oxide is high enough to make an anti-static coating when combined with a photopolymer.
Experimental Set-up

• GO and polymer (PEGDMA) mixed together
• Cured between glass slides with Teflon spacer to make uniform thin film
• 1x3cm rectangles cut for $T_g$ and Stress-Strain testing using a Q800 DMA
• Films cured between ITO glass for conductivity testing
• Conductivity tested using potentiostat and chronoamperometry (CA)
The addition of graphene oxide to a polymer matrix reduced the resistivity by an order of magnitude.
The addition of GO did not significantly impact the $T_g$ of PEGDMA, indicating no negative change in the physical properties.
Stress-Strain Testing

GO-PEGDMA Stress-Strain Analysis

The addition of GO did not significantly impact the toughness of PEGDMA, indicating no negative change in the mechanical properties.
The addition of GO reduced the $T_g$ of the PEGDA system due to the increased reaction rate. The addition of GO initially decreased the $T_g$ of the epoxide but then increased the $T_g$ back to the original temperature due to the epoxide rings on the surface of the GO.
Future Plans

- Covalently bonding functional groups to the surface of GO
- We hypothesize:
  - increased interactions with the polymer matrix
  - increased mechanical strength
  - increased $T_g$
  - increased conductivity
The magnitude of the OH peak decreases in the functionalized GO and the epoxide/NH$_2$ peak sharpens and increases in magnitude, suggesting the epoxide groups disappear and are replace with NH$_2$ groups.
Thank you

Questions?