Dispersion of Graphene Using Large Aromatic Molecules for High-Conductivity Electrodes

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Since its discovery in 2004, graphene is considered as one of the most promising semiconducting materials for electronic applications, owing to its remarkable charge transport ability and high conductivity, meaning that it could be used as conducting materials for electrodes fabrication to replace the ITO and silver. However, pristine graphene flakes are not easily processed chemically and their use as graphene inks for the printing of thin films that preserve the graphene's excellent electronic properties is still an unresolved challenge. Printing graphene-based materials usually involve ink formulations consisting of a mixture of pristine graphene flakes (i.e. not oxidized) and a polymer, or a surfactant, in an organic solvent. Alternatively, stable aqueous suspensions of graphene oxides (GOs) have been developed without surfactants and commercial GOs inks are available to print graphene thin films, but these inks require a reduction step after deposition in order to recover the good properties of graphene, which is not incompatible with printing technology. Surfactants or polymers have been explored to exfoliate pristine graphene flakes and stabilize the particles in solvents, but these insulating chemicals create a barrier to charge penetration and charge transport to the deposited graphene film. As a result, the conductivity of the obtained graphene thin films are much inferior to the pristine graphene.

Here, we will present our most recent effort to disperse graphene using flat, large aromatic molecules to make stable dispersion that can be printed at room temperature of various flexible substrates. Different molecules and conjugated polymers based on anthanthrone, a commercially available vat dye, have been tested. Conductivity measurements using the four-point technique will also be shown. The influence of structural variations on the dispersion ability will be discussed.

Figures

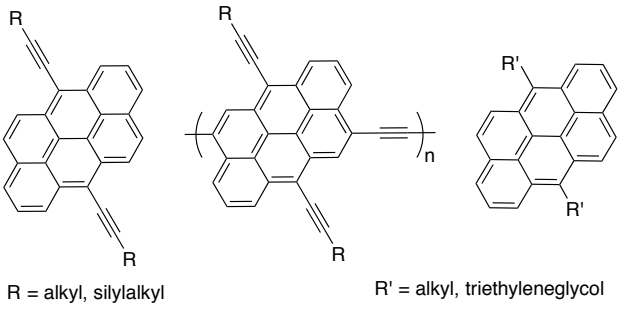

Figure 1: Chemical Structures of Anthanthrene-Based Molecules for Graphene Dispersion