

Gold decorated graphene flakes for large area transparent conductive films

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The scarcity, brittleness, processing limitations and fabrication costs of Indium Tin Oxide (ITO) are crucial limiting factors for the development of flexible displays and electronics requiring flexible, transparent conductors (TCs). Graphene liquid dispersions [1] offer an attractive proposition for roll to roll manufacturing of electronic devices requiring flexible TCEs [2]. We demonstrate an up-scalable gold-decorated graphene based TC. Gold decorated graphene flakes are prepared by refluxing liquid-phase exfoliated graphene flakes with nitric acid to introduce carboxylic groups [3], followed by reduction of gold(III) chloride (AuCl_3) driven by the addition of sodium hydroxide. The carboxylic groups improve the stability of the dispersion, as well as the wettability and processability of the graphene ink during coating. They also enable the efficient decoration of metal nanoparticles onto the graphene flakes. Reduced gold nanoparticles (AuNPs) homogeneously dispersed on the surface of the modified graphene sheets allow to improve the interfacial contact and achieve low sheet resistance. Large-area TC films (up to A4 size) are prepared with sheet resistances $\sim 350 \Omega/\text{sq}$ and $>80\%$ transmittance.

References

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- [2] F. Bonaccorso et al., *Nat Photon.* 4 (2010), 611.
- [3] S. Niyogi et al., *J. Am. Chem. Soc.* 128 (2006), 7720.