N1-010

Enhanced Electrical Conductivity of Gold Doped Graphene Films by Microwave Treatment

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Graphene, with its unique physical and structural properties, has recently become a proving ground for various physical phenomena, and is a promising candidate for a variety of electronic device and flexible display applications. Compared to indium tin oxide (ITO) electrodes, which have a typical sheet resistance of ~60 Ω/sq and ~85% transmittance in the visible range, the chemical vapor deposition (CVD) synthesized graphene electrodes have a higher transmittance in the visible to IR region and are more robust under bending. Nevertheless, the lowest sheet resistance of the currently available CVD graphene electrodes is higher than that of ITO.

In this study, we report a creative strategy, irradiation of microwave at room temperature under vacuum, for obtaining size-homogeneous gold nano-particle doping on graphene. The gold nano-particlization promoted by microwave irradiation was investigated by transmission electron microscopy, electron energy loss spectroscopy elemental mapping. These results clearly revealed that gold nanoparticle with ≥30 nm in mean size were decorated along the surface of the graphene after microwave irradiation. The fabrication high-performance transparent conducting film with optimized doping condition showed a sheet resistance of ≥100 Ω/sq. at ~90% transmittance. This approach advances the numerous applications of graphene films as transparent conducting electrodes.

Keywords: graphene, gold nanoparticle, microwave, transparent conducting film