# Photon-Assisted Reduction of Inter-Sheet Resistance in Graphene Networks for Conductive Coatings

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**Abstract**

Graphene demonstrates enormous potential for lightweight electronic and conducting applications due to their exceptional physical properties. Liquid exfoliation of graphite to graphene is scalable and economical. However, minimizing the energy budget to transform colloidal dispersions into thin-film form with enhanced electrical conduction is the key for reducing the cost of production of graphene thin-films. This study explores annealing of the thin-films using photon sources including Ultra-violet, focussed solar, Infrared radiation and matter-based techniques to control the morphology and electrical resistance of the self-assembled graphene (SAG) nanosheets network [1]. The SAG films are characterized by Raman spectroscopy, electron microscopy and current-voltage characteristics before and after the annealing. We found that, after 10 min of treatment, the Raman defects ratio ($I_D/I_G$) of focussed solar radiation (FSR) annealed SAG films decreased by 65% compared to conventional resistive annealing. The electrical resistance of SAG films is reduced from 40 kΩ to 5 kΩ after the treatment. FSR requires significantly less energy ~17 times less than IR treatment (0.0029 kWh vs. 0.05 kWh) and 146 times less energy than resistive heating (0.0029 kWh vs. 0.425 kWh) to achieve the same unit of fractional change in resistance for graphene thin film [2]. The photon-assisted thermal treatment is a practical and scalable way to improve the performance of graphene-based thin-films for lightweight and electrically conducting channel applications such as flexible electronics and thin-film EMI Shielding [3].

References

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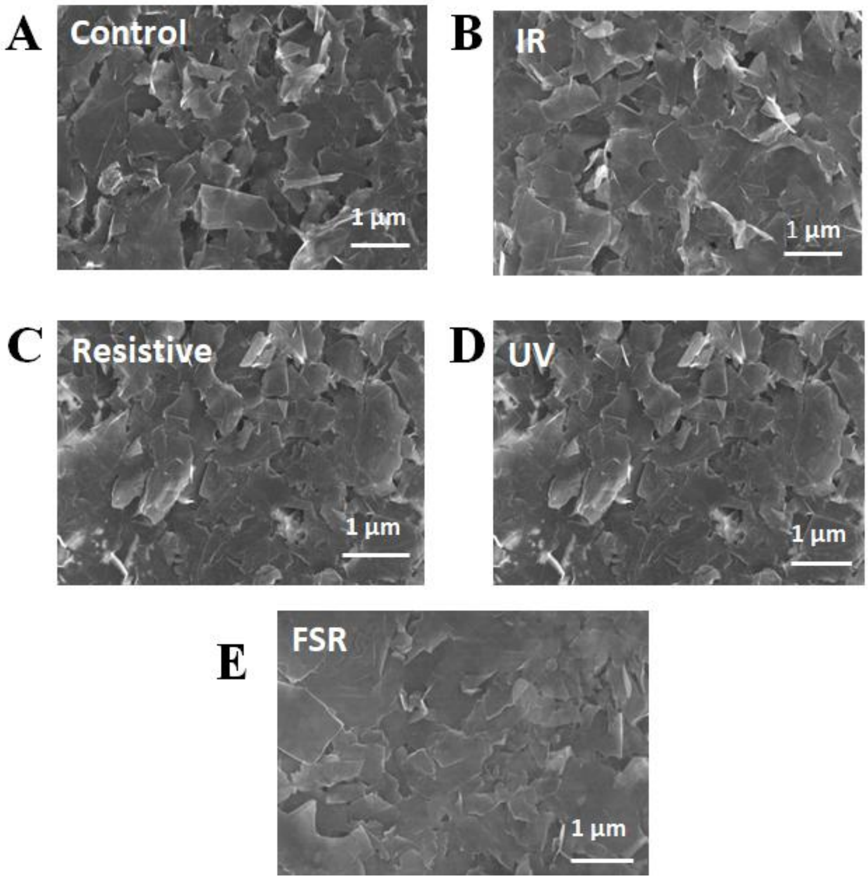


**Figure 1:** Morphology of SAG thin films before and after irradiation. SEM image of (A) SAG (control film), (B) IR irradiation, (C) Resistive heating, (D) UV irradiation and (E) FSR annealing