Abstract No: 122 ***Physical Sciences***

SELECTIVE REDUCTION OF GRAPHENE OXIDE DEPOSITED ON HEAT-SENSITIVE SUBSTRATES

K.H. Madurawala[1], G.C. Wickramasinghe[1], R.M. Manamendra[1] and D.L. Weerawarne[1,2*]

[1]Department of Physics, Faculty of Science,University of Colombo, Colombo 03, Sri Lanka.
[2]Center for Instrument Development, Department of Physics,Faculty of Science, University of Colombo, Colombo 03, Sri Lanka.
[*]dweerawa@phys.cmb.ac.lk

Laser-assisted reduction of Graphene Oxide (GO) deposited on heat-sensitive flexible substrates has become a popular method for scalable production of flexible conductive interconnects. Reduced Graphene oxide (rGO) has gained interest owing to its improved electrical conductivity compared to GO. Usually, the reduction of GO is achieved by large-area thermal processing. However, most flexible substrates used in electronics are heat sensitive and, therefore, require localized heating approaches to produce rGO. This study extensively studied the laser reduction of graphene oxide deposited on a heat-sensitive polyethylene terephthalate (PET). A statistical Design of Experiment (DoE) was performed to optimize the parameters associated with laser reduction and to achieve the minimum possible resistance for rGO. A 785 nm continuous wave (CW) laser was used to study the dependence of the resistance of rGO on the laser power, scribing speed, and the number of scans. The optimal resistance measured for a 1 cm long laser-scribed rGO line was 9.46 ± 0.01 kΩ [0.430 ± 0.001 kΩ/square]. This is over four orders of magnitude improvement in the conductivity compared to oven-dried GO at 110 ^{o}C, which is close to the glass transition temperature of PET. The laser-induced reduction of GO was confirmed by SEM and FTIR. The optimal laser scanning conditions were 490 mW of laser power, 5 mm s^{-1} of scanning speed, and 5 repetitive laser scans on the same pattern. The average width of laser-reduced rGO lines was 450 ± 12 µm. These results suggest that CW laser reduction of GO yields conductive interconnects suitable for the fabrication of chemically inert interdigitated electrodes used in chemi-resistive sensors that change their electrical resistance in response to changes in the chemical environment.

This work was conducted with a grant from UNESCO-TWAS and the Swedish International Development Cooperation Agency (Sida). The views expressed herein do not necessarily represent those of UNESCO-TWAS, Sida, or its Board of Governors.

Keywords: Flexible electronics, Graphene, Laser reduction