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Tuneable and large area μ-patterns of reduced graphene oxide for flexible electronics

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Recently, two-dimensional (2D) layered materials such as graphene and analogous graphene oxide (GO), reduced graphene oxide (rGO) with novel functionalities have absorbed attention of scientific community for electronics applications such as such as sensing, supercapacitors, interconnects, ultra-fast photonics and flexible nano-electronic devices (FETs). Graphene based flexible devices is an emerging field, however the challenges such as large area, low cost growth and scale up synthesis restricts the use of graphene. Therefore the synthesis of graphene has evolved with time and several methods have been demonstrated. As an alternative, the solution processable rGO, obtained via reduction of GO was studied, although, the long term stable dispersion of aqueous rGO hinders its commercial scale applications. Therefore, in the present work we demonstrate a facile and swift and photo-catalytic approach for the preparation of rGO dispersion stable for ~160 days. The stable rGO dispersion may be useful as conductive inks for flexible electronics, conductive electrodes, interconnects. In addition we also present, a tuneable, site specific, scalable and low temperature pattering of GO-rGO films under UV illumination (λ ~365 nm) for circuit elements interconnects and all rGO based flexible FET applications The electrical measurements reveals that the conductivity of the completely exposed rGO is considerably (~150 times) higher than unexposed GO, suggesting the use of rGO in circuit elements, interconnect and flexible electronic applications. The tuneable GO reduction approach is adopted for the fabrication of all-carbon, metal free- rGO-FET, on flexible substrates. On tuning the intensity of UV illumination, the partially exposed rGO was used as a semiconducting channel, while the completely exposed rGO was used as source/drain/gate electrodes The low temperature, site specific, scalable and large area GO-rGO patterning is found to be advantageous wearable flexible and lighter electronics applications.

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