Localized Deoxygenation of Graphene Oxide Films by Focused Ion Beams: Structural Evolution and Direct Writing of Conductive Structures

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Structural modifications to graphene during exposure to energetic particles that includes ion-beams, e-beams has been the subject of extensive theoretical research [1]. We have experimentally studied the effect of ion-beams on films of graphene oxide and observe that the films undergo preferential deoxygenation at low dosages of ion fluence. Areas of GO films unexposed to ion beams had a carbon content of 64±2 % and an oxygen content of 36±2%, which changed to 74.5±2.5% for carbon and 25.5±2.5% for oxygen in the exposed regions demonstrating deoxygenation. A concomitant increase in electrical conductivity by over 2-3 decades was also observed indicating the ability to produce carbon structures analogous to chemically reduced graphene oxide. [2] Progressive increase of ion beam exposure then leads to amorphization, as evidenced by Raman Spectroscopy studies, followed by rupture of the graphene sheets. The phenomena of deoxygenation under controlled dosages can be utilized for direct writing of conductive rGO structures in the length scale of tens of nanometers to hundreds of microns.
