CHARACTERIZATION OF X-RAY IRRADIATED GRAPHENE OXIDE COATINGS USING X-RAY DIFFRACTION, X-RAY PHOTOELECTRON SPECTROSCOPY, AND ATOMIC FORCE MICROSCOPY

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Graphene is a single-layer planar sheet of sp²–bonded carbon atoms that are packed in a two-dimensional honeycomb lattice. Intrinsic graphene behaves like a semi-metal or zero-gap semiconductor. One problem with graphene is that it cannot be dispersed in water, preventing any practical applications that utilize aqueous coating or deposition technology.

Graphene oxide, GO, is generated by treating graphite with strong oxidizers. GO retains the layer structure of graphite but with a larger and irregular basal plane spacing. The name graphene oxide is not correct chemically. Besides oxygen epoxide groups, other functional groups observed to be present are carbonyl, phenol, and hydroxyl groups. It is the presence of the hydroxyl groups that allows GO to be dispersed in water. However, GO does not possess any of the electrical properties observed in graphene. Methods have been developed that convert GO to graphene but this transformed graphene retains defects seen in the original GO, resulting in a graphene that has a reduced conductivity and charge mobility compared to pristine graphene.

In an effort to study an alternative approach to make graphene from GO, exposure of GO to high-energy X-ray radiation has been performed. X-ray Diffraction (XRD), X-ray Photoelectron Spectroscopy (XPS), and Atomic Force Microscopy (AFM) have been used to characterize GO before and after irradiation. Results will be presented that indicate GO exposed to high-energy radiation is converted to an amorphous carbon phase that is conductive.