Advanced Manufacturing of Laser Induced Graphene Electronics

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Introduction

The Johnson Materials Research Group's (JMRG) advanced manufacturing laser lab uses cutting-edge scientific equipment (advanced optics, state-of the art spectrometers, and high-power lasers) and machine-learning algorithms with the aim to manufacture flexible electronics on Graphene Oxide (GO) thin films and Polyurethane based composite coatings for health monitoring and sensor applications.

This experimental setup also has enormous potential in Autonomous Research Systems for new materials discovery when combined with computational methods for materials design.

Methods

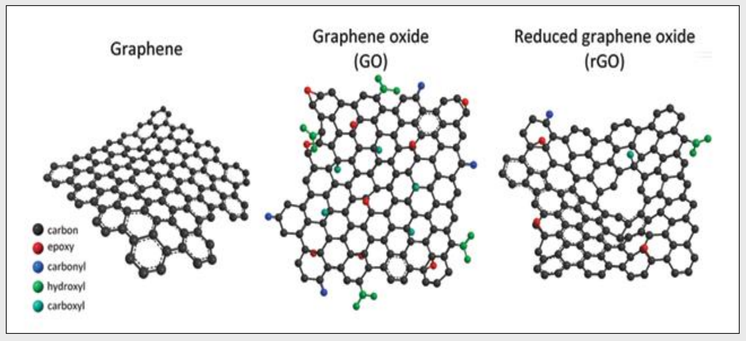


Fig. 1: Schematic chemical structures of graphene, graphene oxide, and reduced graphene oxide.

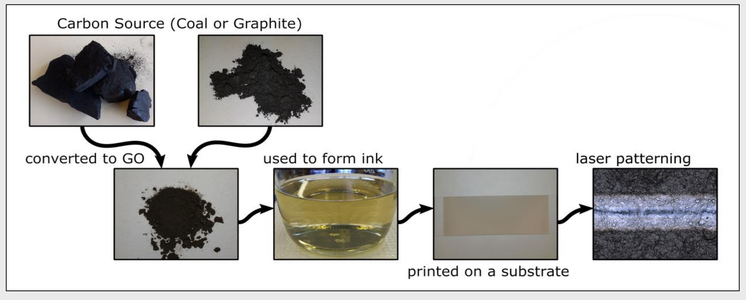
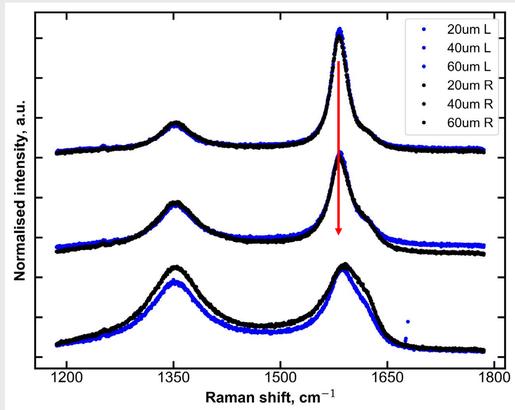


Fig. 2: Graphene electronic device production process

Results



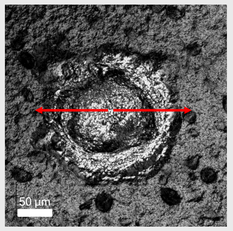


Fig. 3: Linear Raman map showing D (left) and G (right) bands of graphene oxide. The ratio is calculated from the area under the peaks. Lower ratio indicates more graphene-like material

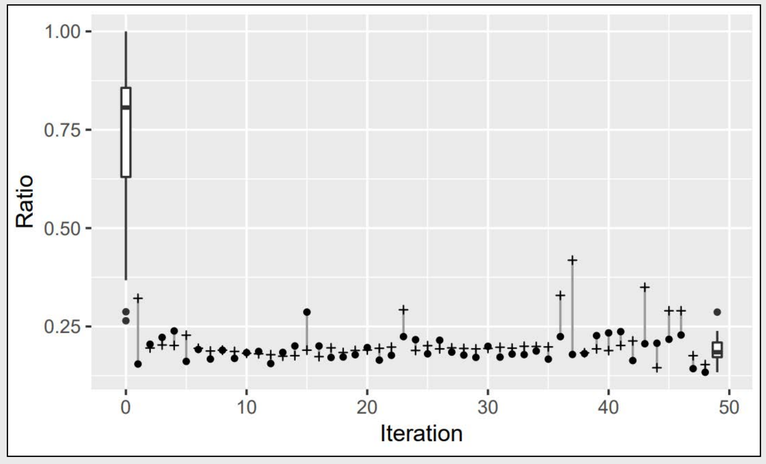
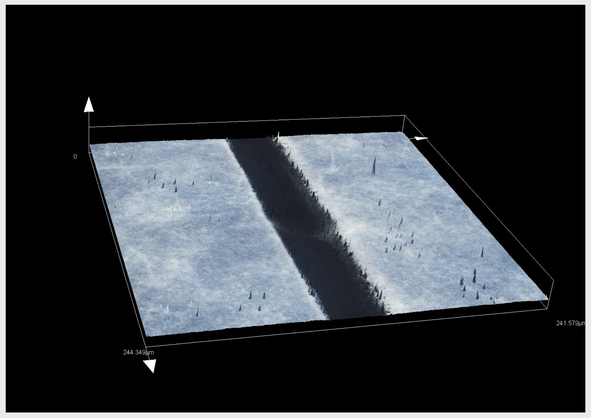


Figure. 4: Ratio of D to G intensities for a set of experiments. On the left of the graph, the distribution of ratios for the training data is shown (iteration 0). The circles show observed data, crosses values predicted by the surrogate model (connected to the corresponding observed value with a grey line). The boxplot on the right of the graph shows the distribution of ratios of the observed values of the configurations that the surrogate model explored. The distribution is better than the distribution from the training data.

Advanced Manufacturing Laser Lab



37 µm wide laser-induced line on graphene oxide

References

E.J.C Amieva, J. Lopez, A.L. Martinez, C. Velasco-Santos. Graphene-Based Materials Functionalization with Natural Polymeric Biomolecules, Recent Advances in Graphene Research, Pramoda Kumar Nayak, IntechOpen, DOI: 10.5772/64001. October 12th 2016.

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