

Multi-step Microwave Irradiation for a Fast Exfoliation of Graphite for the Synthesis of Graphene Oxide (GO) and reduced GO (rGO)

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We investigated the microwave treatment conditions that could ensure efficient exfoliation of graphite powders for high quality graphene or GO flakes: the type and amount of oxidants, microwave irradiation cycle conditions, and microwave power. We presented progressive physicochemical changes of exfoliated graphite under the repeated steps of microwave irradiation up to five times. As the number of irradiation treatment increased, the 2D peak width of Raman spectroscopy was decreased, which was likely to indicate that the number of graphite layers was decreased. As the irradiation times were increased, the peak at 26° in the XRD pattern decreased and simultaneously the peak at 12° increased, which was ascribed to the fact that the inter-layer distance of graphite was increased through intercalation and partial exfoliation of graphite. In the analysis of X-ray photoelectron spectroscopy, the ratio of oxygen to carbon was increased with the repeated microwave irradiation process. Overall, it was demonstrated that the microwave irradiation technique could intercalate and/or exfoliate the graphite layers through oxidative reactions, which could be used to synthesize graphene or GO flakes.