

Inspectional analysis to produce graphene oxide using Sri Lankan natural vein graphite

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Sri Lankan vein graphite has remarkable properties that can be used in different technological applications such as energy conversion, nanotechnology etc. Especially, the graphene oxide (GO), that is used for many advanced nanotechnological applications, can be produced using Sri Lankan vein graphite. In this study, GO was synthesized using highly purified Sri Lankan natural vein graphite. However, instead of employing typical Hummer's synthesis method with a single oxidizing agent of KMnO_4 , a mixture of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ oxidizing agents was used for this study. The main objective was to obtain different levels of interlayer expansion in graphene oxide. The synthesized GO was characterized by X-ray Diffraction (XRD), micro-Raman spectroscopy and Scanning Electron Microscopy (SEM) techniques. The XRD phase analysis clearly showed the expansion of the interlayer distance of graphite from 3.34 \AA to 7.46 \AA after synthesizing to GO. The higher d-spacing in GO could result due to lattice expansion and intercalation of oxygen-containing functional groups to the graphite lattice. Interestingly, this interlayer spacing 7.46 \AA is considerably different to that reported by ordinary Hummer's method (0.86 nm). The SEM analysis showed that the oxidized graphite has exfoliated into several layers forming porous networks that resemble a loose sponge-like structure. Further, the micro-Raman analysis confirmed that I_D/I_G ratio increases with the oxidation of graphite. The average crystallite size of sp^2 domain calculated was 21.36 nm for chemically oxidized GO. However, the crystallite size decreases with increasing degree of oxidation, which associates with the breaking of crystallites resulting in the formation of defects, vacancies, and distortions. Altogether, this study showed the capability to synthesize graphene oxide from Sri Lankan natural vein graphite by the method used in this study. Furthermore, the finding of this study can be useful to produce expanded graphite with different interlayer spacing.