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Comparative analysis of the oil absorbancy in expanded Needle-type and platy-type graphite samples from sri lanka

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Expanded graphite (EG), produced by intercalating and applying heat, exhibits a porous and oleophilic structure, making it highly effective for oil absorption and environmental remediation. This research aims to study the oil absorption capacity of needle-type and platy-type graphite samples in Sri Lanka. Graphite samples were intercalated using a mixture of concentrated sulfuric and nitric acid (8:1) v/v ratio, followed by washing with ultrapure water, then heated at 600 °C for 15 minutes to expand into worm-like structures, with slight damage to the sheets. Regarding oil absorption capacity, needle-type EG exceeded platy-type EG, with 1g absorbing 68.62 g against 34.30 g, respectively. The evidence suggests that the main sorption mechanism is based on the degree of exfoliation according to the extent of expansion. The intensity ratios of the D-band at 1353 cm^{-1} to the G band at 1580 cm^{-1} in Raman spectra were used to determine different degrees of exfoliation and defect density in these materials. Needle-type graphite had an I_D/I_G ratio of 0.044, and its defect density (nD) was calculated as 1.51×10^{10} cm^{-2}, while platy type I_D/I_G ratio stood at 0.012 and a defect density of 0.412×10^{10} cm^{-2}. Heat treatment reduced defect density by factors of 1.21 and 4.27 for needle-type and platy-type graphite, respectively. This reduction is attributed to the removal of oxygen and sulfur functionalities by heat treatment, increasing sp^2 hybridized graphitic carbon sites. Additionally, the smaller crystal size of needle-type EG (377.05 nm) compared to platy-type EG (1345.51 nm) gave it a greater surface area for oil absorption. The absorbed oil can be recovered by simple squeezing, allowing the reused expanded graphite to maintain its efficacy.

Keywords: Expanded graphite, Degree of exfoliation, Defect density, Oil absorption