Toward Scalable Synthesis of Reduced Graphene Oxide: Using Chemical Reduction Approach

Anjali K
Shrilakshmi G, Ayana C B, Sreejith P Babu, M N Muralidharan and Seema A*
Centre for Materials for Electronics Technology, Thrissur, Kerala, India
*E-mail: seema@cmet.gov.in

Abstract

The practical use of reduced graphene oxide (rGO) in large-scale applications requires synthesis routes that are not only efficient but also reproducible and suitable for batch-level production. In this work, we report a high-yield batch synthesis of rGO using the improved Hummers method, developed as part of a dedicated production line. Yield level is above 83%, with high consistency and reproducibility across batches [1]. The mixed-acid oxidation system used in this synthesis enables uniform oxidation while reducing hazardous gas and heat generation. Process optimization of the synthesis workflow enables guaranteed repeatability across each batch while ensuring systematic handling of the steps involved. Specialized protocols governing reaction handling, washing steps, reduction control, and material extraction enhance operator safety and simplify handling. The resulting rGO has characteristics suitable for electrochemical applications, especially as a supercapacitor electrode material. Its highly porous structure and restored sp^2 domains enable effective ion transport and charge storage [2]. The material exhibits consistent capacitive performance, suggesting that device-level research can benefit from it. The Raman spectra of synthesised rGO shows D band and G band at 1341.5cm^{-1}, 1599.9 cm^{-1} respectively. From BET analysis the surface area of the synthesised rGO is found to be ~586 m^2 g^{-1}. The rGO is separated into two sizes: 325 and 50 mesh, which can be utilized for different applications. Overall, this work provides a feasible path toward scalable rGO production for energy storage and related applications by demonstrating a yield-focused, repeatable, and optimized method.

References

[1] J Chen, B Yao, C Li, G Shi, Carbon, 64 (2013) 225-229
[2] H Yu, B Zhang, C Bulin, R Li, R Xing, Sci Rep, 6 (2016) 36143

Figures

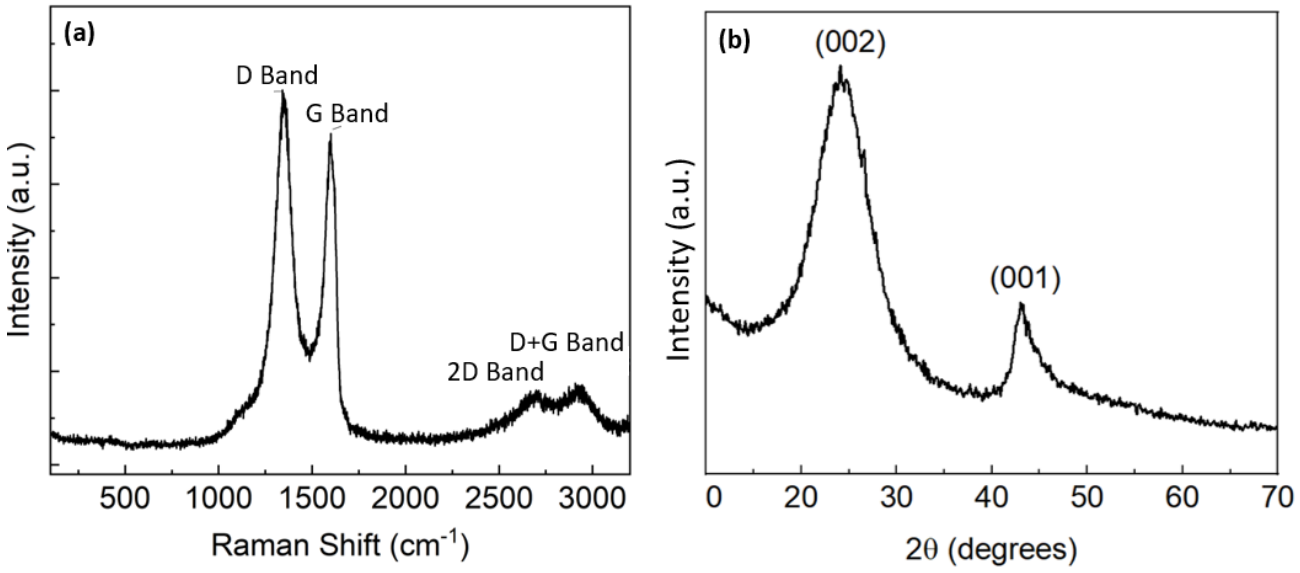

Figure 1 (a) Raman spectra and, (b) XRD pattern of as-synthesised rGO.