Journal Article – Volume 31, Issue 5, Advanced Powder Technology 2020, Pages 2072 - 2078

Structural study on graphene-based particles prepared from old coconut shell by acid–assisted mechanical exfoliation

Abstract

This work is aimed to identify the structure of the graphene-based particles (GPs) from old coconut shell as the raw material after the mechanical exfoliation processes. The burnt coconut shell was at first heated at 400 °C for 5 h in ambient air. The sample was then stirred in an acid solution (HCl) and then continued by ultrasonication and centrifugation. The exfoliated GPs were characterized by x-ray diffraction (XRD), particle size analyzer (PSA), Fourier-transform infrared spectroscopy (FTIR), scanning and transmission electron microscopy (SEM and TEM, respectively), atomic force microscopy (AFM), Raman spectroscopy, and synchrotron wide and small angle x-ray scattering (WAXS and SAXS, respectively). The XRD and WAXS analyses show Bragg peaks corresponding to a pure phase of reduced graphene oxide (rGO). PSA, SEM/TEM, AFM, and Raman analyses show that the use of HCl-assist in the solution during the exfoliation process has successfully reduced particle size of the obtained GPs. SAXS pattern of the exfoliated GPs using the assist of HCl, confirmed by TEM and AFM images, results in the specific particle sizes of between 1.42 and 4.99 nm. The present mechanical exfoliation technique has successfully been applied to obtain several nanometers of GPs and provides an alternative of simple synthesis of biomass – based graphene products.