Biomass graphene nanosheets prepared based on group coordination assembly method using corn cobs cellulose and its application in Healfiber®

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Abstract

Graphene has attracted increasing attention because it's unique nanostructure and holds great promising potential applications in different fields such as composite materials, sensors, batteries and supercapacitors. Recently, single- or few-layer graphene sheets have been prepared by several methods including chemical vapor deposition (CVD), micromechanical exfoliation, and chemical reduction of graphene oxide (GO). However, the low productivity of the micromechanical exfoliation makes it unsuitable for large-scale use. Reduction and exfoliation of GO appears to be a much more efficient approach for bulk production of graphene sheets. Unfortunately, this functionalization of GO disrupts the electronic structure of graphene. Although the modified groups can be removed by reduction, it leaves a large number of defects, which continue to affect the electronic properties of graphene. Thus, a facile and efficient strategy to produce high quality and large yield graphene is urgently required.

In this study, we provided a novel approach to design and synthesize porous graphene nanosheets with a high S_{BET} via an effective simultaneous activation graphitization route from corn cobs cellulose. This novel method, group coordination assembly (GCA), and the whole process of our strategy is to simultaneously introduce graphitization catalyst precursor and activating agent into the framework of the cellulose based on the coordinated action of the functional groups in the carbon source with the metal precursor. After carbonization at elevated temperatures under a N_2 atmosphere, the metal components can catalyze graphitization of the carbon source[1].

Importantly, the metal (Fe) components can form a carburized phase in the heating process, and the formation–decomposition process of the carburized phase can lead to the formation of graphene nanosheets. After removing metal (Fe) components, porous graphene nanosheets were obtained. The novel processes have many advantages such as renewable raw materials, non-pollution green process, low cost, and can meet large-scale preparation.

To the best of our knowledge, there is no report on the use of corn cob cellulose as the carbon source to synthesize porous graphene nanosheets. While the rationally designed structure of graphene nanosheets possesses several major advantages: (1) Shengquan graphene sheets about 3-7 layers; (2) layer adjustable and controllable; (3) Raman spectra of IG/ID is greater than 10, low defect degree; (4) specific surface area greater than 300 m^2/g; (5) its conductivity as high as 4000 S/m.

In 2015, Biomass graphene viscose composite fiber, Healfiber®, was produced in SQ Group, China [2]. Healfiber® has unique health benefits:

(1) Far infrared Ray: Improves skin microcirculation and immune system.
(2) Anti-bacterial activity: deep cleaning the skin.
(3) Dissipates static electricity: prevent skin itching and splotchy pigmentation.
(4) UV resistant: preventing skin wrinkles, spots, and skin aging.

References

[1] Sun L, Tian C, Li M, et al. Journal of Materials Chemistry A, **21** (2013) 6462-6470.
[2] Tian M, Qu L, Zhang X, et al. Carbohydrate polymers, **111** (2014) 456-462.

Figures

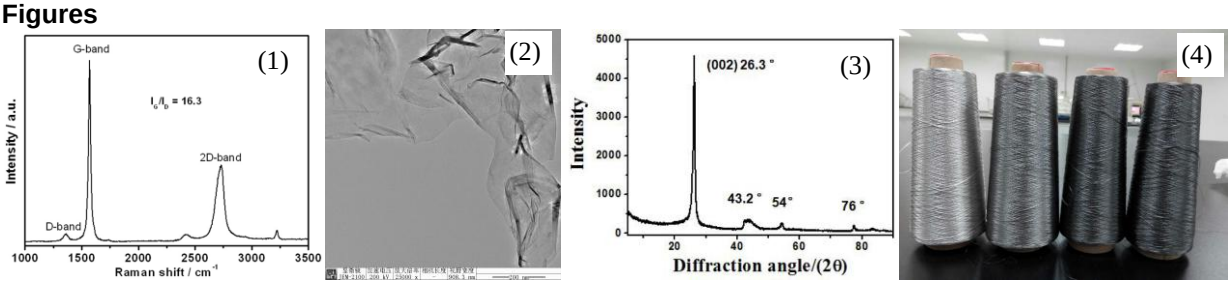

Fig.1 Laman (1) 、TEM (2)、XRD (3) of Biomass graphene, and (4) Healfiber® .