Reduction of Graphene oxide using candle flame for Supercapacitor application

Mohanapriya. K. and Neetu Jha
Institute of Chemical Technology, Matunga, Mumbai, India.
Kmohanapriya.ms@gmail.com

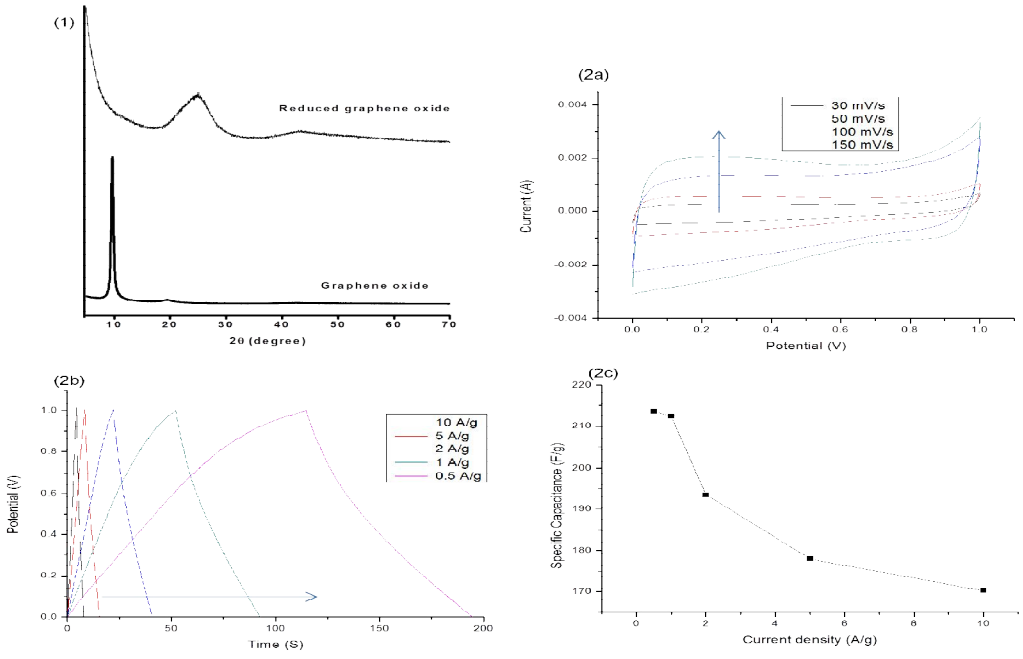
Abstract

With a fast-growing market for portable electronic devices and the development of hybrid electric vehicles, there has been an ever increasing and urgent demand for energy storage devices that are of high energy density and high power density [1]. Supercapacitors have attracted much attention in recent years because of their pulse power supply, long cyclic life, simple operational mechanism, and high dynamics of charge propagation. Carbon-based materials including activated carbon, carbon nanotubes and graphene have been widely used in electrochemical double-layer supercapacitors owing to their excellent physical and chemical properties. Significantly, utilizing graphene as a supercapacitor electrode material has become the focus of a considerable amount of research in the field of clean energy devices due to the beneficial combination of the excellent mechanical and electrical properties and large surface area. Our aim is focussed on reduction of graphene oxide by a very simple, safe, chemical free and cost effective method. Here, we describe the preparation of reduced graphene oxide (R-GO) by rapid and scalable flame induced reduction of graphene oxide using a candle. X-ray diffraction (XRD) pattern of reduced graphene oxide confirms the complete reduction (Figure 1). Further it was confirmed by Fourier transform infrared spectroscopy. The electrochemical performances were studied by two electrode system using electrochemical workstation (Figures 2a and 2b). The obtained specific capacitance values for flame reduced graphene oxide are 212 and 170 F/g at current densities of 1 and 10 A/g (Figure 2c). These results are highly comparable with the flame induced reduction of graphene oxide using common lighter by D. Sun et al [2]. Stability of the supercapacitor electrodes were also studied up to 1000 cycles and it was retained 85% of its capacitance. Therefore, these excellent electrochemical performances endow the graphene material as a promising candidate electrode for high-rate supercapacitors.

References

[1] L. L. Zhang and X. S. Zhao, Chemical Society Reviews, **38** (2009) 2520.
[2] D. Sun, X. Yan, J. Lang and Q. Xue, Journal of Power Sources, **222** (2013) 52**.**

Figures



Figures - (1) XRD pattern of GO and R-GO. (2a) Cyclic voltammetry curves measured at different scan rates. (2b) Galvananostatic charge/dischage curves at different current densities. (2c) Specific capacitance at current densities ranges from 1 to 10 A/g.