Chapter 9

APPLICATIONS OF THREE DIMENSIONAL (3D) GRAPHENE NETWORKS AS AN ELECTRODE MATERIALS FOR SUPERCAPACITORS

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1. INTRODUCTION

Graphene, a two-dimensional atomic-thick carbon allotrope, has been discovered in 2004 by Andrei Geim and Konstantin Novoselov, following discoveries of fullerenes and carbon nanotubes (Novoselov et al., 2004). After, it is not surprising that graphene has gained immense attention in material science and engineering thanks to its unique properties such as optical, mechanical and electronic properties, besides surface morphology. Several studies have been conducted to understand the physical and chemical properties of graphene, and a variety of approaches have been investigated to find out an innovative, low-cost, eco-friendly process to produce high-quality graphene structures. 2D graphene has a large theoretical surface area (~2630 m^2. g^{-1}), excellent electron carrier mobility (10,000 cm^2. V^{-1}. s^{-1}), high thermal conductivity (3000–5000 W. m^{-1}. K^{-1} at room temperature), good optical transparency (~97.3%) and excellent mechanical strength with the Yong's modulus of 1.0 TPa (Stankovich et al., 2006; Nair et al., 2006; Lee at al., 2008, Balandin et al., 2008).

There are some methods based on top-down and bottom-up approaches to produce 2D graphene structures. In the top-down approach, it is started from graphite, in the other one from small molecules that are used to build up graphene (bottom-up approach). Not only is the isolation of one layer of graphite a challenge but so also is the stabilization of the exfoliated layers of graphene. If layers

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Ultimately, it is worth believing that through concerted efforts of researchers, novel 3D graphene architectures with more fascinating properties will be designed and fabricated, and the electrochemical energy storage systems based on the novel porous 3D graphene neteworks and its nanocomposites will exhibit more remarkable performance.

Keywords: Three dimensional graphene, Applications, Energy Storage Systems, Supercapacitors.

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