Nanomesh Graphene for Supercapacitor Applications

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Abstract

Supercapacitors (SCs), also known as electrochemical capacitors (ECs), have attracted increasing attention owing to their fast charge and discharge rates, long cycle life and their ability to complement Li-ion and other advanced secondary batteries [1].
Among the various kinds of carbonaceous materials that have been employed to fabricate SCs, the one-atom-thick two-dimensional (2D) sp^2 carbon structure of graphene has attracted considerable interest by virtue of the fact that its ideal structure offers a unique combination of good mechanical/chemical stability, high electrical/thermal conductivity, and a large surface area of over 2630 m^2 g^{-1}. Especially, due to the high theoretical surface area of single layer graphene, it is expected to have high specific capacitance (550 F g^{-1}) as an electrode material for SCs applications [2]. However, solution processing results in aggregation of graphene nanosheets due to strong van der Waals forces of attraction, leading to lower values of surface area and lesser number of electrochemically active sites thereby giving lower than the theoretically expected value [3]. Therefore, the current status calls for new and innovative strategies to enhance the charge storage properties of graphene-based materials.
In this study, we report on nanomesh graphene as an electrode material for SCs applications (Fig. 1) The nanomesh graphene with nanoperforation shows edge effect from defects, dangling bonds and functional groups associated with the terminal edges of graphene and stronger quantum effects derived from neck-width (< 20 nm) in micron-size graphene [4, 5]. More details will be discussed at the meeting.

References

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Figure

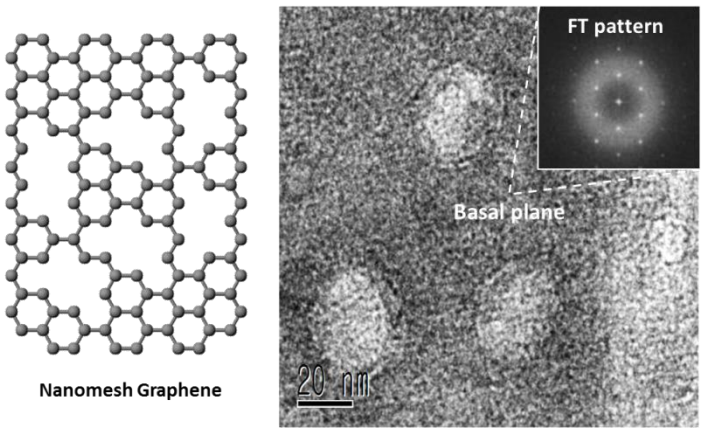

Figure 1. Schematic illustration and TEM image of nanomesh graphene (inset: FT pattern)