# Supercapacitive Behavior of Copper Oxide Nanoparticles on a Graphene Oxide Network

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Nanostructured materials have been used increasingly in different applications in past decade, including pervasive application in energy storage systems [۱,۲]. This arises from their outstanding and superior properties mainly originate from their high surface-to-volume ratios. Supercapacitors can complement batteries in electrical energy storage when high power delivery is needed, due to their higher power density, higher energy efficiency, and longer cycle life than batteries. Transition metal oxides have extremely been used as supercapacitor electrodes. Among different metal oxides, CuO can be a promising candidate since it is chemically stable, low cost, abundant, and nontoxic. Besides being useful in Li ion battery anodes [۳], little works has been carried out on the application of CuO as supercapacitor electrodes [۴]. The main restriction of these electrodes is their low electrical conductivity and unstable cycling performance, Problem which may be solved by using nanostructuring and utilizing the excellent properties of graphene based materials.

Herein, we report the synthesis of nanostructured CuO under ultrasonic irradiation of a solution of copper (II) nitrate which sodium hydroxide was gradually added and then subjected to a thermal treatment. Also, graphene oxide (GO) was synthesized through the Hummer's modified method [۵]. The Synthesized CuO nanoparticles were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and FTIR. Based on the obtained results, the average size of ۵۰ nm was obtained for the prepared particles. The synthesized CuO nanopartilces were sprayed on copper foil to make electrodes and their electrochemical behavior was investigated by different techniques including cyclic voltammetry (CV) and galvanostatic charge/discharge in a supercapacitor design. In order to improve the electrochemical behavior of the samples, working electrodes were fabricated by spraying a thin layer of GO, then covered with the CuO nanoparticles and were subjected to electrochemical tests. Based on the charge/discharge studies, the GO/CuO electrodes have a specific capacitance over ۱۵۰ F.g-۱ in discharge current of ۱۰۰mA.g-۱. The cycle performance and rate capability of the samples were investigated.

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