Flexible Micro-supercapacitors with Flash Lamp Processed Graphene-Carbon Nanotube Electrodes

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ABSTRACT

As the portable electronic devices become smaller, thinner, and lighter, it is desirable to develop miniaturized power sources. Micro-supercapacitors (MSCs) represent a class of power systems that can be integrated into miniaturized electronic devices and provide a peak power to electronic components in the device. The state-of-the-art MSCs can be fabricated with an electrode with high effective surface area. In this regard, it is essential to fabricate carbon-based electrodes with highly accessible surface area and three-dimensionally (3D) interconnected pore structures and develop a scalable micro-fabrication technique to produce micro-patterned thin-film electrodes on a flexible substrate. Herein, we present a facile and scalable method to fabricate a flexible micro-supercapacitors based on graphene-based electrodes on a flexible substrate. We employed flash lamp annealing (FLA) technique to rapidly convert a thin film of graphene oxide (G-O) into an electrically conductive graphene. FLA processing allowed us to produce an interdigitated array of graphene micro-electrodes on a flexible substrate for a very short time in a matter of micro to milliseconds. The direct patterning of graphene electrodes on flexible substrate by FLA processing simplifies the fabrication of graphene-based MSCs. The performance of the FLA-processed MSC will be discussed in terms of volumetric capacitance, specific energy and power, and mechanical flexibility.