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High Temperature Flexible Supercapacitors Using Graphene Electrodes

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Abstract

With increasing demand for high performance energy storage systems, the feasibility of reliable and functional energy storage devices that well operates under extreme conditions is of prime importance for expanding applicative fields as well as for understanding materials' intrinsic and extrinsic properties and device physics. Our group has been investigating the control in the physical structure and chemical composition of 2D graphenes and beyond for ultracapacitive energy storage devices under limited circumstances, where conditions are classified into thermodynamic (e.g. pressure, volume and temperature) and kinetic (e.g. high rate and frequency) variables. We also studied a fundamental foundation via in-situ spectroscopic techniques to understand charge storage phenomenon of new materials and devices occurring on a nanoscale under various circumstances. In this talk, I will introduce high temperature operating, flexible supercapacitors based on graphene electrodes that can efficiently deliver electrical energy under electrochemical, mechanical and thermal stresses [1-4]. In order to achieve high performance supercapacitor devices under thermal, mechanical and electrochemical stresses, the micro- and macroscopic structures and chemical compositions of graphenes are delicately controlled by chemical modification. A new generation of flexible supercapacitors, with the long-term durability and outstanding electrochemical properties, were realized, showing a high position of the Ragone plot, even under severe conditions.

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