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Supercapacitors based in 3D graphene foams

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Graphene stands out for many different properties (electrical, optical, structural, mechanical, thermal, etc.), which can improve the performance of existing devices or enable new applications. In particular, energy storage by means of supercapacitors and batteries is foreseen to be one of the main fields in which graphene will be exploited in the near future. Graphene can be prepared by several techniques. Chemical vapor deposition (CVD) using catalytic metal foils or thin films has demonstrated high quality single or few-layer graphene. Similarly, 3D graphene structures can be grown by CVD on metal foams, useful for supercapacitor electrodes. The graphene foam (GF) processing involves material growth, substrate removal and, eventually, functionalization of its surface. We are using plasma enhanced CVD to grow the graphene on a metal foam acting as a catalytic scaffold. The graphene properties are controlled by the growth conditions, optimized for the metal selected. A free-standing GF is then obtained by wet etching of the metal template. Finally, the GF is functionalized by different techniques and with various materials to modify the graphene surface properties and to provide robustness of the 3D structure. In this work, we will discuss several demonstrations of GF-based electrodes for supercapacitors, either by filling the GF with electrodeposited sponges of polymer nanostructures, or coating the GF with different oxides by electrodeposition or sol-gel. GF-based composite electrodes can also be exploited for batteries and other energy-storage devices.

Biography

Jorge Pedrós received his PhD degree from the Department of Electronic Engineering at Universidad Politécnica de Madrid (Spain) in 2007. After being a Postdoctoral Fellow at the Cavendish Laboratory, University of Cambridge (UK), he returned to UPM in 2012. He currently works on the growth of graphene by CVD and the development of graphene devices for electronic, plasmonic, and energy-storage applications. He has coauthored more than 30 publications and is the PI of 2 research projects.

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