Polyaniline-coated carbon papers for supercapacitor electrodes

Dong Joo Choi[1], Alberto Boscá[2], Jorge Pedrós[2,3], Javier Martínez[2], Violeta Barranco[4], José María Rojo[4], Fernando Calle[2,3,*], and Young-Ho Kim[1,*]

[1]Division of Materials Science and Engineering, Hanyang University, Seoul, 133-791, Korea

[2] Instituto de Sistemas Optoelectrónicos y Microtecnología, ETSI Telecomunicación, Universidad Politécnica de Madrid, 28040 Madrid, Spain

[3] Moncloa Campus of International Excellence UCM-UPM, 28040 Madrid, Spain

[4]Instituto de Ciencias de Materiales de Madrid, Consejo Superior de Investigaciones Científicas, 28049, Madrid, Spain

*Corresponding author: Fernando Calle (e-mail: fernando.calle@upm.es) and Young-Ho Kim (e-mail: kimyh@hanyang.ac.kr)

Graphene and carbon nanotubes are promising materials for supercapacitor electrodes because of their high specific surface area and excellent electrical, thermal, and mechanical properties. However, these materials suffer from a high manufacturing cost and some aggregation of graphene layers or the presence of toxic residual metallic impurities of carbon nanotubes. Carbon paper is also an attractive material for supercapacitors because it presents several advantages such as good conductivity, chemical stability, high porosity, cost effectiveness, and can be used as collector and mechanical support. The capacitance of the carbon paper can be improved by combining with polyaniline (PANI) due to its high pseudocapacitance. In this study, carbon paper was coated with PANI nanofibers using *in situ* polymerization of aniline. Prior to the PANI coating, an acid treatment was performed to modify the surface of the carbon paper for enhancing PANI adhesion by sonication in a mixture of concentrated sulfuric and nitric acids. The loading mass density of PANI on acid-treated carbon paper increased more than three times compared to the untreated carbon paper. The specific capacitance also increased from 112 to 176 F/g (calculated using a total mass of carbon paper and PANI). Moreover, this carbon paper-PANI composite shows high chemical stability from 0 to 1 V in 2M sulfuric acid electrolyte. Thus, the energy density of this composite is higher than those provided by PANI composites only stable up to 0.8 V in acidic electrolyte. The PANI-coated carbon paper is a binder-free electrode, and can be used as flexible supercapacitor electrodes.