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Manufacturing of a nanostructured hybrid electrode material via microwave energy-based approach and its use in energy storage applications

Selcuk Poyraz

Adiyaman University, Turkey

A hybrid electrode material (HEM), composed of carbonized conducting polymer (CP), i.e. polypyrrole nanofibers (PPy NFs), nanostructured zinc oxide (nano-ZnO) and carbon nanotubes (CNTs), was prepared for energy storage applications. HEMs were obtained through a one-step, hassle-free, rapid and highly efficient microwave (MW) energy-based approach. The overall morphology and content of the nano-ZnO and CNT compounds could be altered by simply changing the process parameters, i.e. ratios in the feedstock mixture or the MW process time. The thermal and morphological features, crystalline nature, elemental composition and also the electrochemical performance of the as-prepared HEMs were thoroughly investigated by using relevant material characterization methods such as scanning and transmission electron microscopy (SEM, TEM), energy dispersive X-ray spectroscopy (EDX), cycling voltammetry (CV) and galvanostatic charge/discharge (CD) tests. It was revealed that by synergistically blending the high conductivity from CNTs, the ultra-high porous surface area from carbonized NFs and the abundant pseudo-capacitive features from nano-ZnO in its structure, the as-synthesized HEMs could afford to exhibit promising capacitive performance (~ 190 F/g at 2 mV/s), excellent long-term CD stability (~ 90% during 2000 cycles), high energy and power densities (~ 35 Wh/kg at 500 W/kg) along with high specific surface area (~ 35 m2/g) for energy storage applications.

Biography

Poyraz has completed his PhD at Auburn University (Alabama/USA). He is an assistant professor of Department of Textile Engineering at Adiyaman University. He has published 22 papers in reputed journals and has been serving as a scientific researcher for his field of interest.

spoyraz@adiyaman.edu.tr

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