Energy density Improvement of electrochemical energy storage systems

Mohammad Safi Rahmanifar

Faculty of Basic Sciences, Shahed University, P. O. Box 19575-361, Tehran, Iran

rahmanf_m@yahoo.com, rahmanfm@shahed.ac.ir

Renewable energy sources, such as wind and solar, have enormous potential to reduce dependence on fossil fuels and greenhouse gas emissions in the electric segments. Both solar photovoltaic and wind energy have variable and uncertain output, which are unlike the dispatch able sources used for the majority of electricity generation in the world. There has been an increased demand for the deployment of energy storage as an essential component of future energy systems that use large amounts of variable renewable resources. In these cases, electrochemical energy storage devices, including batteries and supercapacitors, play an important role. For this reasons, there is an increasing research interest on the electrochemical energy storage devices [1].

Batteries have ranges from miniature batteries with an energy storage capability of less than 0.1 Wh to capacities greater than 10 MWh. All such systems utilize the energy evolved by electrochemical reactions to produce electric power directly. But electrochemicalsupercapacitors can store energy using a single or combination of various charge storage mechanisms, the electrochemical double layer (ECDL) and electrochemical reactions [2].

Several general strategies for improving energy density of electrochemical energy storage systems have been developed, such as improving of high energy advanced materials, nanostructuring of active materials, active materials morphology, hybridization of electrochemical energy storage systems, configuration design, surface modification of electrodes,composition optimization, and electrolyte.

In this article some of the above methodswere reviewed.

Reference:

[1] Z. Yang, J. Zhang,M. C.W. Kintner-Meyer, X. Lu, D. Choi, J. P. Lemmon,J. Liu., Chem. Rev., 111 (2011) 3577-3613.

[2] C. Liu, F. Li, L. Ma, H. Cheng,Adv. Mater. 22(2010) E28–E62.