Metal Borides For Supercapacitor Electrodes Materials

Hasan Göçmez

Kütahya Dumlupınar University, Faculty of Engineering, Metallurgical and Materials Engineering Department, 43100 Kutahya/Turkey

Supercapacitors (SCs) are energy storage devices commonly used in various applications that require an instantaneous power supply and fast response times; however, achieving high performance requires continuous development and tailoring of electrode materials. An ideal electrode for SC should exhibit high specific capacity and specific capacitance. The materials of choice for efficient SCs should have good electronic and ionic conductivity, high surface area and porous structure. In recent years, a significant amount of research has been devoted to improving the electrochemical performance of supercapacitors by developing new electrode materials.

This study uses a low-cost solution-based process to synthesize metal borides (TiB2 and ZrB2) powders for supercapacitor electrode material. Boric acid and metal based precursors are the primary materials to obtain powders. The structural and morphological characterization of synthesized powder was conducted by XRD, FE-SEM, EDS, DTA-TG, FTIR, Raman, and EPR measurements. Electrochemical measurements were performed using the Parstat MC multi-channel potentiostat. Metal borides were used for measurement as an electrode for symmetric and asymmetric devices, and graphite or multilayer carbon nanotube powders were used for an asymmetric device as a second electrode. The electrochemical impedance spectra (EIS) of synthesized materials confirmed their significant capacitive performance, which may be valuable in energy storage and harvesting microdevices for future electronics.

Keywords: Metal Borides, Solution Process, Energy Storage, Supercapacitors