Abstract

Herein, the sonochemical technique was used to create a nickel-based metal organic framework (Ni-MOF), and conductive polymers including MXene, polypyrrole (Ppy), and polyaniline (PANI) were added to increase the framework's efficiency. To confirm the materials' structural and chemical properties, XRD, FTIR, and elemental analysis were employed. Galvanostatic charge-discharge (GCD), electrochemical impedance spectroscopy (EIS), and cyclic voltammetry (CV) were utilized to analyze electrochemical activity in both two and three-electrode assembly. With an Es of 11 Wh/kg and a Ps of 1280 W/kg, the Ni-MOF/PANI (NP) electrode had the best performance of all the composites that were created. In addition, Dunn's method was applied to distinguish between capacitive and diffusive charge contributions, providing deeper insight into the charge storage process. The results demonstrate that NP is a highly efficient electrode material with strong potential for advancing next-generation hybrid supercapacitors.

Keywords: Hybrid supercapacitor, 1,2,4,5-Benzenetetracarboxylic acid, 4,4'-Bipyridine, Ni-MOF, PANI, Ppy, MXene, electrochemical applications