2024

International Conference on Green Electrochemical Technologies

綠色電化學科技國際研討會 暨 2024台灣電化學學會年會

11 / 08 - 09 National Chung Hsing University

台灣電化學學會 The ElectroChemical Society of Taiwan

國立中興大學

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So far, various types of the electrolyte materials have been successfully tested in supercapacitors but the aqueous electrolytes, which belong to the group of liquid-based electrolytes, are still the most frequently studied due to their accessibility and costs [1]. However, their electrochemical stability window (ESW) is very low due to the water decomposition on the electrodes at 1.23V. Another branch of liquid-based electrolytes constitutes the organic electrolytes and ionic liquids. They offer much wider ESW than aqueous electrolytes but they are toxic and quite expensive. Recently, it has been developed cheaper equivalent of ionic liquid electrolyte which is based on a deep eutectic solvent (DES), i.e., a fluid composed of two or three components which are capable of self-association mainly due to the presence of hydrogen bonds and their interactions [2]. Completely different group of electrolyte materials is related to solid-state electrolytes whose main advantages are high ESW, no leakage of electrolyte, flexibility, and stability [3].

Taking the advantage of both DES and solid-state electrolytes, a new synthesis path towards the quasi-solid state electrolyte composed of gel-like polymer membrane soaked with DES solvent is proposed herein. In this work, the DES is based on an aqueous mixture of LiClO4 and methylsulfonylmethane (MSM), while the pomer membrane constitutes the porous poly(vinylidene fluoride-co-hexafluoropropylene) (PVDF-HFP) film. The prepared electrolyte material has been morphologically, structurally and electrochemical characterized with use of several complementary methods such as: XRD, FTIR, Raman Spectrocopy, SEM, BET, CV, and GCD. The obtained results indicate that the investigated hybrid quasi-solid state electrolyte material satisfies all necessary conditions for the application in high-voltage supercapacitors.

References

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