World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:18, No:06, 2024

Partially Fluorinated Electrolyte for Lithium-Ion Batteries

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Abstract : For a high-voltage cell, severe capacity fading is usually observed when the commercially carbonate-based electrolyte is employed due to the oxidative decomposition of solvents. To mitigate this capacity fading, an advanced electrolyte of fluoroethylene carbonate, ethyl methyl carbonate (EMC), and 1,1,2,2-Tetrafluoroetyle-2,2,3,3-tetrafluoropropyl ether (TTE) (in vol. ratio of 3:2:5) is dissolved with oxidative stability. A high-voltage lithium-ion battery was designed by coupling sulfured carbon anode from polyacrylonitrile (S-C(PAN)) and LiN0.5Mn1.5 O4 (LNMO) cathode. The discharged capacity of the cell made with modified electrolyte reaches 688 mAhg-1S a rate of 2 C, while only 19 mAhg-1S for the control electrolyte. The adopted electrolyte can effectively stabilize the sulfurized carbon anode and LNMO cathode surfaces, as the X-ray photoelectron spectroscopy (XPS) results confirmed. The developed robust high-voltage lithium-ion battery enjoys wider oxidative stability, high rate capability, and good cyclic performance, which can be attributed to the partially fluorinated electrolyte formulations with balanced viscosity and conductivity.

Keywords : high voltage, LNMO, fluorinated electrolyte, lithium-ion batteries
Conference Title : ICEECE 2024 : International Conference on Energy, Environmental and Chemical Engineering
Conference Location : Toronto, Canada
Conference Dates : June 13-14, 2024