Carbon nanoparticles application in polymer electrolyte materials for energy storage

S.O. Gaidukov[*1], A. Jurkane
[1] *Riga Technical University, Faculty of Material Science and Applied Chemistry, Institute of Polymer Materials, Institute of Applied Chemistry, P. Valdena Street 3, Riga, LV-1048, Latvia.*

Graphene/carbon nanotubes/poly(oxyethylene) (GR/CNT/PEO) nanocomposites were prepared by solution and melt processing methods. Solid and gel-like polymer composite electrolyte was prepared by a blending method with the use of lithium triflate (LiTrf). PEO gels were prepared by crosslinking with 2,5-Bis(tert-butylperoxy)-2,5-dimethylhexane (Luperox® 101). The morphology, structure, and dielectric properties of the ternary nanocomposites were investigated by dielectric spectroscopy (DS), volume and surface resistivity measurements, X-ray powder diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), calorimetry (DSC) and microscopy (OM). The ionic mobility of the polymer composite electrolytes was measured in the solid and swelled state. Ethylene carbonate (EC), propylene carbonate (PC), dimethylformamide (DMF) were used as solvents for the electrolyte preparation and further investigations. The XRD patterns and DSC thermograms testify the polymer crystallinity in the obtained composite electrolyte. The composite electrolyte exhibited the best conductivity properties with the optimum LiTrf content and swelling equilibrium. The spatial network structure developed by the nanoparticles acts as reinforcement for the ionically conductive polymer electrolyte phase. Nanocelulose (NC) was added as ternary filler for the electrolyte preparation. The excellent ion conductivity and stability properties of processed NC/GR/CNT/PEO composites electrolyte indicated their great potential as energy storage material for rechargeable battery application.

* sergejs.gaidukovs@rtu.lv