Investigation on Degradation and Viscoelastic Relaxation of Li Ion in Chitosan Based Solid Electrolyte

Shujahadeen B. Aziz^{1,2*}, M. A. Brza^{3,1}, M. F. Z. Kadir⁴, M. H. Hamsan⁴, Z. H. Z. Abidin⁴,
Dana A. Tahir⁵, Omed Gh. Abdullah^{1,2}

¹ Advanced Polymeric Materials Research Lab., Department of Physics, College of Science, University of Sulaimani, Qlyasan Street, Sulaimani, Kurdistan Regional Government-Iraq

² Development Center for Research and Training (DCRT), University of Human Development, Qrga Street, Sulaimani, Kurdistan Regional Government-Iraq

³ Faculty of Engineering, International Islamic University of Malaysia, kuala Lumpur, Gombak, Malaysia

⁴ Centre for Foundation Studies in Science, University of Malaya, Kuala Lumpur, Malaysia

⁵ College of Science, Physics Department, University of Halabja, Halabja, Kurdistan Regional Government-Iraq

*E-mail: shujaadeen78@yahoo.com, shujahadeenaziz@gmail.com

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Ion transport has been the subject of debate among scientists for more than three decades. This paper discusses the preparation, degradation and viscoelastic relaxation dynamics of ions in chitosan-based solid electrolyte. The dielectric properties and viscoelastic relaxation process of chitosan:LiCF₃SO₃ (CS:LiTf) solid electrolyte were examined by means of electrochemical impedance spectroscopy (EIS). The high values of dielectric constant (ϵ') and dielectric loss (ϵ'') at low frequency were ascribed to electrode polarization phenomena. The decrease of both ϵ' and ϵ'' at higher temperatures could be ascribed to the degradability of chitosan-based solid electrolyte. The real part of electrical modulus shows that CS:LiTf system is highly capacitive. The asymmetric peak of the imaginary part (M'') of electric modulus suggests the non-Debye type of relaxation. The frequency dependence of dielectric loss (ϵ'') and imaginary part (M'') of electric modulus revealed good coupling between polymer segmental and ionic motions. The master curve obtained from the scaling of M'' spectra at various temperature was helpful in understanding the dielectric processes taking place in the CS:LiTf electrolyte. The temperature dependence of the conductivity relaxation time (τ_σ) follows the Arrhenius equation. The viscoelastic relaxation dynamic of the chitosan-based solid electrolyte was investigated by two methods.

Keywords: Polymer electrolyte; Degradation; Dielectric constant; Dielectric loss; Electric modulus; Scaling; viscoelastic relaxation; Ion dynamics.

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