

Development of Ionic Liquid Crystals Based on Benzotriazolium Salt as Redox Electrolyte for Dye-Sensitized Solar Cell

Ahmad Mudzakir, Kurnia, Yayan Sunarya and Arie Hardian
Department of Chemistry Education, Indonesia University of Education (UPI) Bandung
(e-mail: zakir66@upi.edu)

Abstract

The aim of the research is to produce ionic liquid crystals for dye-sensitized solar cell (DSSC). Ionic liquid crystal system that expected to synthesized is 1,3-alkyl-methyl-1,2,3-benzotriazolium salts. The research produce three compounds of benzotriazolium salt with different anion structure, i.e. bromide (Br), thiocyanide (SCN), and tribromoargentat (AgBr_3). 1-methyl-3-hexadecyl-1,2,3-benzotriazolium bromide are synthesized from 1-H benzotriazole using condensation thermal method adopted from Forsyth,2003. The other compound is synthesized using anion metathesis. Characterization using Infrared Spectroscopy (FTIR) and Proton Nuclear Magnetic Resonance ($^1\text{H-NMR}$) is suitable with expected compounds. Analysis of physicochemical properties using Differential Scanning Calorimetry (DSC). Physicochemical analysis using Thermal Gravimetry-Differential Thermal Analysis (TG-DTA) show that these compounds have high thermal stability with decomposition temperatures for each compounds are $313,9^\circ\text{C}$ for 1M3HdBzt Br; $282,4^\circ\text{C}$ for 1M3HdBzt SCN; and $312,7^\circ\text{C}$ for $[\text{1M3HdBzt}]_2[\text{AgBr}_3]$. Analysis using cyclic voltammetry (CV) show that these compounds have electrochemical windows approximately ± 2 V. Analysis using Electrochemical Impedance Spectroscopy (EIS) show that resistance of 1M3HdBzt SCN is lowest ($0,354 \text{ kohm.cm}^2$) at 25°C , the resistance value of 1M3HdBzt Br and $[\text{1M3HdBzt}]_2[\text{AgBr}_3]$ are 1,582 and $7,366 \text{ kohm.cm}^2$, respectively.

Keyword: DSSC, redox electrolyte, ionic liquid crystals, and 1,3-alkyl-methyl-1,2,3-benzotriazolium.