ABSTRACT

The main focus of this present work is to build a good conducting solid polymer electrolyte (SPE) based on chitosan and poly(vinyl alcohol)(PVA) blend. Solution cast technique has been employed to produce sample films in this work. From the scanning electron micrographs (SEM) the surface morphology of the blend containing 40 wt.% chitosan and 60 wt.% PVA (C4P6) is homogenous and miscible in one and another. The C4P6 film is the most amorphous and is the best candidate for the polymer host in the electrolyte systems studied in the present work. Ammonium Nitrate (NH_4NO_3) is the doping salt that provides the conducting ions. The highest conducting film in the salted system has a composition of 60[C4P6]-40AN with a conductivity value of 2.07 x 10^{-5} S cm^{-1}. Ethylene carbonate (EC) was introduced as a plasticizer to enhance the conductivity of the highest conducting sample in the salted system. The composition of the highest conducting sample in the plasticized system is 30[60C4P6-40AN]-70EC. The highest conductivity obtained for the sample 30[60C4P6-40AN]-70EC is 1.60 x 10^{-3} S cm^{-1}. The addition of salt and plasticizer has increased the conductivity of the blended host from which it can be inferred that the conductivity is influenced by the number density of charge carriers. Transport parameters for both polymer-salt and plasticized systems have been calculated using the Rice and Roth model. The conductivity at various temperatures for both polymer-salt and plasticized systems have been observed to obey Arrhenius rule. The activation energy, E_a for the highest conducting polymer-salt system is 0.30 eV and that of the plasticized system is 0.14 eV. From infrared studies, interaction between PVA/chitosan-NH_4NO_3 and EC with NH_4NO_3 were observed. Proton batteries with configuration Zn/30[60C4P6-40AN]-70EC/MnO_2 have been fabricated. The open circuit potential (OCP) of the fabricated proton batteries was between 1.60 to 1.70 V. With addition of (30[60C4P6-40AN]-70EC) in the liquid form into the cathode, the proton battery can be recharged. The highest conducting electrolyte sample (30[60C4P6-40AN]-70EC) was also used as a separator in EDLC fabrication. The EDLC exhibited 0.95 V working voltage and can perform for 100 cycles at different current drains of 0.095 and 0.381 mA cm^{-2}.