

CHAPTER 9

CONCLUSION AND SUGGESTION FOR FURTHER WORK

The Al_2TiO_5 was prepared using the sol-gel technique and its formation was confirmed from the XRD studies. The mole ratio of aluminium nitrate to titanium dioxide is 0.08:0.02. Chitosan was used as the polymer host. Chitosan, NH_4SCN and filler (Al_2TiO_5) were mixed in certain weight percentages and dissolved in 100 ml of 1% acetic acid solution.

Conductivity value for pure chitosan acetate is $1.67 \times 10^{-10} \text{ S cm}^{-1}$ at room temperature. For the chitosan – NH_4SCN system, the highest conducting sample containing 1 g chitosan and 40 wt. % NH_4SCN . This sample exhibits a conductivity of $1.38 \times 10^{-4} \text{ S cm}^{-1}$ at room temperature. The increase in conductivity is attributed to the increase in number of charge carriers. The decrease in conductivity for samples containing more than 40 wt.% salt is due to increase in crystallinity of the polymer electrolyte. From the plot of conductivity at various temperatures, the conductivity is thermally assisted. The plot is Arrhenian. The activation energy of chitosan- NH_4SCN is 0.096 eV. The dielectric constant ϵ_r plot versus frequency at different temperatures is another proof that conductivity is affected by temperature. As the temperature increased the dielectric constant also increased resulting in conductivity enhancement.

To enhance the room temperature conductivity for the chitosan- NH_4SCN system, Al_2TiO_5 was added in various concentrations. The conductivity was increased to $2.10 \times 10^{-4} \text{ S cm}^{-1}$ for chitosan- NH_4SCN added with 5 wt.% Al_2TiO_5 . The temperature dependence conductivity for this system follows the Arrhenius rule. The activation

energy of chitosan-NH₄SCN-Al₂TiO₅ is reduced to 0.091 eV. The reduction in activation energy implies the possibility of the filler to provide additional pathways for ion transport to take place with a slightly lower activation energy.

Studies on chitosan-Al₂TiO₅ spectra suggested that there is hardly any interaction between polymer host and filler. However there are some shifts to indicate the possibility of the presence of hydroxide groups on the filler surface. The infrared spectroscopy studies have clearly shown that the NH₄SCN interacts with the chitosan to form chitosan-NH₄SCN complexes as a result of the shift of amine and carboxamide bands to lower wavenumbers.

Amorphousness and crystallinity of the sample can affect the conductivity where the more amorphous and lower crystallinity sample has resulted in higher conductivity. This has been illustrated by the SEM micrographs and XRD pattern studies.

SUGGESTION FOR FURTHER WORK

Future work should continue to enhance the conductivity of the electrolyte to as high as 10⁻³ or 10⁻² S cm⁻¹. The conductivity of the composite polymer electrolyte should be enhanced by introducing a second suitable filler to the electrolyte or probably using two fillers. Basically, it is hard to obtain or make a filler uniformly distributed within the sample using only a magnetic stirrer. A better method to ensure the filler is well distributed is by using an ultrasonic system to disperse the filler. Besides that, the filled system can be blended with plasticizer such as polyethylene glycol (PEG). The use of a second or third plasticizer, but still with filler should also be considered. Besides that, more characterization should be done on the system i.e. by

using differential scanning calorimetry (DSC), thermogravimetry analysis (TGA) to determine the effect of filler on the thermal stability of the composites.