

CONCLUSIONS

The major obstacle in developing successful solid polymer electrolytes is the low ionic conductivity at ambient temperatures which is due to the low segmental mobility of polymer chains and crystallinity of the polymer materials. The introduction of ionic plasticizers and γ irradiation of the PVC powder have been

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Sample	Composition	Conductivity (S/cm)
1	PVC	10^{-10}
2	PVC + 10% + LiClO ₄ SO ₃	2.15×10^{-7}
3	PVC + 10% + LiClO ₄ SO ₃ + EC (γ-irradiated PVC)	6.73×10^{-7}
4	PVC + 10% + LiClO ₄ SO ₃ + EC (γ-irradiated PVC)	4.11×10^{-7}
5	PVC + 10% + LiClO ₄ SO ₃ + EC + PVC	2.60×10^{-7}

Table 6.1. Summary of highest electrical conductivity at room temperature for different kinds of PVC based polymer electrolytes.

Conductivity-temperature studies indicate that the ionic transport is sensitive to both to ionic crystals i.e. jumping from one defect site to another. The nature of ionic plasticizer groups varies as well increasing ionic conductivity and also water. The

6.0 CONCLUSIONS

The major obstacle in developing successful solid polymer electrolytes is the low ionic conductivity at ambient temperature which is due to the low segmental mobility of polymer chains and crystallinity of the polymer materials. The introduction of salts, plasticizers and γ - irradiation of the PVC powder have been used as a convenient method to increase the ionic conductivity at ambient temperature to values applicable for device fabrication. Table 6.1 summarizes the highest electrical conductivity achieved for the different kinds of PVC based polymer electrolytes.

No	Compound	Conductivity (S/cm)
1	Pure PVC	10^{-8}
2	PVC + LiBF ₄ + LiCF ₃ SO ₃	5.15×10^{-6}
3	PVC + LiBF ₄ + LiCF ₃ SO ₃ + EC	6.33×10^{-6}
4	PVC + LiBF ₄ + LiCF ₃ SO ₃ + EC (γ - irradiation technique)	4.51×10^{-4}
5	PVC + LiBF ₄ + LiCF ₃ SO ₃ + EC + PC	2.60×10^{-3}

Table 6.1 : Summary of highest electrical conductivity at room temperature for different kinds of PVC based polymer electrolytes.

Conductivity – temperature studies indicate that the ionic transport is similar to that in ionic crystals i.e. hopping from one defect site to another. The value of activation energy decreases with increasing ionic conductivity and vice versa. For

the present study the transference number results imply that the major conducting species are anions (CF_3SO_3^- and BF_4^-).

X-ray diffraction spectroscopy reveals that salts and plasticizers disrupt the crystalline nature of PVC based polymer electrolytes and converts them into an amorphous phase. This explains the increase in ionic conductivity. XRD also shows shifted peaks which is an evidence that complexation has occurred between the salts and the polymer.

DSC studies suggest that plasticized samples exhibit lower values of T_g and heat capacity. This reduced heat capacity in polymer electrolyte samples mean that the crystallinity is reduced. TGA studies show that the thermal stability of the polymer electrolytes decrease with increase in plasticizer content.

We have successfully shown that the PVC based polymer electrolyte films can be used as an electrolyte to make a solid state polymer cell. The results suggest that the better performance of the batteries can be obtained at lower discharge current values. However, work needs to be carried out to improve the battery performance. We suggest the use of polymer blends such as PVC-PMMA and PVC-PEO as host polymers in future. These blends will have better ionic conductivity and better mechanical strength.