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# CHARACTERIZATION OF POLY (VINYL CHLORIDE) BASED ELECTROLYTES AND BATTERIES

BY

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# DECLARATION

I hereby declare that the work reported in this dissertation is my own unless specified and duly acknowledged by quotation.

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Ramesh T. Subramaniam

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# ABSTRACT

*Poly (vinyl chloride) has an electrical conductivity of $10^{-8}$ $Scm^{-1}$. It can serve as a host matrix for solvating lithium salts. The highest room temperature electrical conductivity of 5.2 x $10^{-6}$ S/cm was achieved for the composition of 50 wt % PVC, 15 wt % $LiCF_3SO_3$ and 35 wt % $LiBF_4$. The conductivity value was still in the order of $10^{-6}$ S/cm upon adding ethylene carbonate (EC). With the aim to raise the room temperature ionic conductivity of PVC based polymer electrolyte and considering that the ionic conduction preferentially occurs in the amorphous phase, the PVC powder was irradiated and the crystallinity was further suppressed by plasticizing with ethylene carbonate (EC). By incorporating $LiBF_4$ and $LiCF_3SO_3$ to the above described polymer host, the ambient ionic conductivity of the electrolyte could reach as high as 4.5 x $10^{-4}$ S/cm. The conductivity was further enhanced by adding both ethylene carbonate (EC) and propylene carbonate (PC) as plasticizers. At room temperature the conductivity value of 2.60 x $10^{-3}$ S/cm was obtained with a concentration of 9 wt % PVC, 2.7wt% $LiCF_3SO_3$, 6.3 wt % $LiBF_4$, 12 wt % EC and 70 wt % PC. The conductivity-temperature data of plasticized PVC electrolytes follows the Arrhenius relationship. In addition, the polymer electrolyte samples were investigated using transference number, X-ray diffraction, DSC and TGA techniques. The sample which shows highest ionic conductivity at room temperature was used to assemble a solid state battery and its characteristics were presented and discussed.*

## Chapter 2



## Chapter 3



## Chapter 4