# Optimization and Structural Analysis of a Gel Polymer Electrolyte Based on Polyacrylonitrile to be used for Na Batteries

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Today, an insurgence has arisen on non Li based batteries to meet the escalating energy demand. Na, Mg, and Zn are some of the suggested alternatives. Simultaneously, attention was focused on replacing liquid electrolytes due to their inherent drawbacks such as leakage, evaporation and high reactivity. One solution is employing quasi solid state gel polymer electrolytes (GPEs). Main objective of this study is preparing, optimizing and structural analyzing of a GPE to be used for Na batteries. GPE based on polyacrylonitrile (PAN) was prepared using the salt sodium thiocyanate (NaSCN) and the solvents, ethylene carbonate (EC) and propylene carbonate (PC). Materials were heated and the resultant was pressed between two glass plates to obtain a thin film. This procedure was repeated varying the polymer and the salt concentrations. The composition was fine tuned to obtain the highest room temperature conductivity. The structure analysis was done using X Ray Diffraction (XRD) technique. XRD measurements were carried out for two samples — with and without salt. The highest conductivity observed was $1.92 \times 10^{-3}$ S $cm^{-1}$ from the sample 202.5 PAN: 500 EC: 500 PC: 35 NaSCN (weight basis). When the polymer concentration was increased, conductivity increased first. However, further increase of polymer reduced the conductivity. This may be a result of interplay between dissociation of ion pairs and viscosity of the medium. Similarly, amount of charge carriers and their mobility governs the conductivity and results an optimum conductivity at a particular salt concentration. XRD results clearly suggest that crystalline phase in the PAN: EC: PC structure diminishes upon addition of the salt. It implies that the GPE is in amorphous phase and based on the conductivity value, it is suitable to be employed for Na rechargeable batteries.

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