

Section 2

Executive summary of the project:

Although solid polymer electrolytes are emerging as the most suitable electrolyte material for a new generation of solid state electrochemical power sources, their practical applications have not been realized up to now due to their low room temperature ionic conductivity.

Under this research project, mainly two types of solid polymer electrolytes were studied. Those based on Polyethylene oxide (PEO) and PEO oligomers and those based on Polyacrylonitrile (PAN). Polymer electrolytes based on PEO were synthesized by common solvent casting technique or by hot pressing technique. The effect of nano-sized ceramic fillers such as Titania (TiO_2) as well as Illmenite (available in Sri Lanka) on the ionic conductivity and other properties of these electrolytes was systematically studied. Anionic conducting electrolytes were synthesized by incorporating iodide salts such as tetrapropylammonium iodide ($\text{Pr}_4\text{N}^+\text{I}^-$) or KI. Dye sensitized photoelectrochemical solar cells based on these polymer electrolytes will be fabricated and tested for their quantum efficiency.

Large cations such as Pr_4N^+ , does not form strong bonds with oxygen atoms in PEO chains. The ionic conductivity of PEO- $\text{Pr}_4\text{N}^+\text{I}^-$ solid polymer electrolytes are very low and the addition of TiO_2 as a filler does not improve the iodide ion conductivity. Gel electrolytes based on PAN and LiBF_4 show promising conductivities, while showing strong cation-solvent and cation-anion interactions. The gel electrolytes prepared with PEO oligomer, tetraglyme, and KI show promising ionic conductivities. The dye sensitized solar cells assembled with the gel electrolytes based on tetraglyme and KI have efficiencies around 3.7%.