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Optical, Thermal and Electrical studies of PVP based solid Polymer electrolyte For Solid state battery applications

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Abstract: A combination of ion conducting solid polymer electrolytes based on PVP (poly vinyl pyrrolidone) polymer was prepared by solution casting technique. The optical properties were studied by using UV-visible Absorption spectroscopy in the range of 200-800 nm. The absorption band gap is studied it is due to polymer chain complexed with salt. The complexation between (PVP and $Mgcl_26H_2O$) has been observed from FTIR.The Glass Transition temperature was measured form DSC.The D.C Conductivity was measured at temperature range 303K to 373K. The ionic conductivity of PVP Polymer electrolyte is about $1.02x10^{-9}$S/cm at Room temperature (RT).The highest ionic conductivity is found to be 2.05 $x10^{-5}$ S/cm at 373K, for 85:15 compositions. The ionic conductivity in the conduction process to be the Arrhenius-type thermally activated process. In these polymer electrolytes Charge carries of transference number is calculated by using Wagner's polarization technique. From the Transport Properties it concludes that in this polymer electrolyte the charge carries takes place mostly due to ions. The total ionic and electronic transference number was found to be 0.98 and 0.02in this solid polymer electrolytes.By using these polymer electrolytes a Solid state battery has been fabricated as well as discharge characteristics were studied under the constant load of 100kΩ. With the configuration of Mg^+/(PVP+$Mgcl_26H_2O$)/(I_2+C+electrolyte).Different battery parameters such as open-circuit voltage (OCV),short circuit current (SCC),energy density, and power density has been calculated.

Keywords: FTIR, DSC, Optical properties, Polymer electrolytes, Ionic Conductivity, Transference number, Electrochemical cell, and Discharge Characteristics.

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