Preparation and Characterization of amphiphilic poly(vinyl chloride)-g-poly(oxyethylene methacrylate) graft polymer electrolytes and application to dye-sensitized solar cells

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Graft polymerization of ion-conducting POEM side chains from the hydrophobic PVC main chains was successfully carried out via an ATRP process. The resultant graft copolymer was complexed with a metal salt (LiI) or an ionic liquid (MPII) to form a polymer electrolyte. The coordinative interactions and structural changes of polymer electrolytes were investigated using FT-IR spectroscopy and wide angle X-ray scattering(WAXS). Transmission electron microscopy (TEM) revealed that the d-spacing between PVC domains was significantly increased upon the introduction of metal salt, ionic liquid and oligomer, indicating their selective confinement in the hydrophilic POEM domains. The ionic conductivity and DSSC efficiency were maximized at 1.2×10^{-4} S/cm at 25 ◦C and 5.0% at 100mW/cm^2, respectively, upon utilization of PVC-g-POEM/(LiI+ MPII)/PEG electrolyte. These good performances were attributed to the microphase-separated morphology of the electrolyte in that the ion-conducting POEM domains were well interconnected. These flexible solar cells have potential applications to smart window or battery.