Solid-state Dye-Sensitized Solar Cells based on Poly(oxyethylene methacrylate)-Poly(4-vinyl pyridine) Comb-like Polymer Electrolytes

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Poly(oxyethylene methacrylate)-poly(4-vinyl pyridine) (POEM-P4VP) comb-like copolymer was synthesized via atom transfer radical polymerization (ATRP), as confirmed by 1H-NMR and FT-IR spectroscopy. POEM-P4VP was quaternized with 1-iodopropane (1:1 weight ratio) to modify the pyridine groups into the pyridinium ions, i.e. POEM-qP4VP. Transmission electron microscope (TEM) showed that strongly segregated microphase-separation in POEM-P4VP was less prominent upon quaternization due to interactions between the ether oxygens of POEM and quaternized pyridine groups of qP4VP, as confirmed by FT-IR spectroscopy. The ionic conductivity of quaternized POEM-qP4VP electrolytes (2.0 × 10-5 S/cm at 25 oC) was higher than that of pristine POEM-P4VP electrolytes (1.9 × 10-6 S/cm) due to higher concentrations of free iodide ions. As a result, the energy conversion efficiency of dye-sensitized solar cell (DSSC) employing quaternized polymer electrolytes (1.93 % at 100 mW/cm2) was higher than that employing pristine electrolytes (1.38 %).