

Polymer electrolyte membranes with high ion conductivity and mechanical strength via bicontinuous crosslinking reaction for supercapacitor

문승재, 강미소, 김종학[†]
연세대학교 화공생명공학과
(jonghak@yonsei.ac.kr[†])

Bicontinuously crosslinked polymer electrolyte (BCPE) membranes which have high ionic conductivity and excellent mechanical strength are prepared. These are synthesized via facile ring-opening polymerization without any solvent. The reaction between the PEI amine groups and the epoxy groups of PEGDE and BADGE induced the unique crosslinking structure in the presence of an ionic liquid (EMIMTFSI). The homogeneous dispersion of IL in PEO domains is due to good miscibility of the IL with the polymer matrix. Therefore, the solid electrolyte membranes possess two distinct regions which are PEO-based epoxy resin domains and ion conductive domains. These two domains contribute to good mechanical properties and high ion-conductivity ($2.41 \times 10^{-3} \text{ S cm}^{-1}$ at 25 °C), respectively. Solid-state supercapacitors fabricated with the BCPE membranes exhibit a high capacitance of 19.8 F g^{-1} at 2 mV s^{-1} and show high capacitance retention and coulombic efficiency close to 100% over 10,000 cycles.