Recent Development of Li-Ion Conductive Polycarbonate Electrolytes for Battery Applications

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In this study, we are focusing on the chemical structure of polymer framework for the development of ion-conductive properties of solid polymer electrolytes (SPE). In our previous works, we have suggested carbonate structure which can be obtained by the alternating copolymerization of carbon dioxide (CO_2) with epoxides, and comprised novel polymer candidates for SPE. Copolymerization of carbonate and ether units was carried out for obtaining homogeneous electrolytes without phase separation showing excellent Li ion-conductive properties. The random copolymers of ethylene oxide with CO_2 (poly(ethylene carbonate/ethylene oxide), P(EC/EO)) containing lithium salt exhibited ionic conductivities and Li transference numbers (t_+) higher than 0.4 mS cm^{-1} and 0.6 at 60 ºC. To study ion-conductive behavior of P(EC/EO)-based electrolytes, the FT-IR technique has been used to analyze the interactions between Li ions and functional groups of the copolymer. We revealed that the carbonate groups interact preferentially with Li ions rather than the ether groups in P(EC/EO). High performance P(EC/EO)-based electrolyte can be expected a candidate material for use in all-solid-state flexible batteries.

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Research Interest: Polymeric and composite materials for batteries, biomass, smart and intelligent devices and medical applications. He has prepared and tested a lithium-ion cell using new polymer electrolytes working at room temperature to develop flexible solid batteries.