PEO/Garnet Composite Electrolytes for All–Solid–State Lithium Batteries: from "Ceramic–in–Polymer" to "Polymer–in–Ceramic"

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Composite polyethylene-oxide/garnet electrolytes containing LiTFSI as the lithium salt have a Li^+ conductivity $\sigma_{Li}>10^{-4}$ S cm^{-1} at 55 °C, a wide electrochemical window, high thermal stability and a low plating/stripping impedance of a dendrite-free Li-metal anode; they have been developed for a safe all-solid-state Li-metal rechargeable battery. Composites consisting of "ceramic-in-polymer" to "polymer-in-ceramic" that are flexible and mechanically robust are fabricated by hot-pressing. All-solid-state $LiFePO_4$|Li cells with electrolytes of "ceramic–in–polymer" and "polymer–in–ceramic" deliver excellent cycling stability with high discharge capacities (139.1 mAh g^{-1} with capacity retention of 93.6 % after 100 cycles) and high capacity retention (103.6 % with coulombic efficiency of 100 % after 50 cycles) at 0.2 C and 55 ºC.

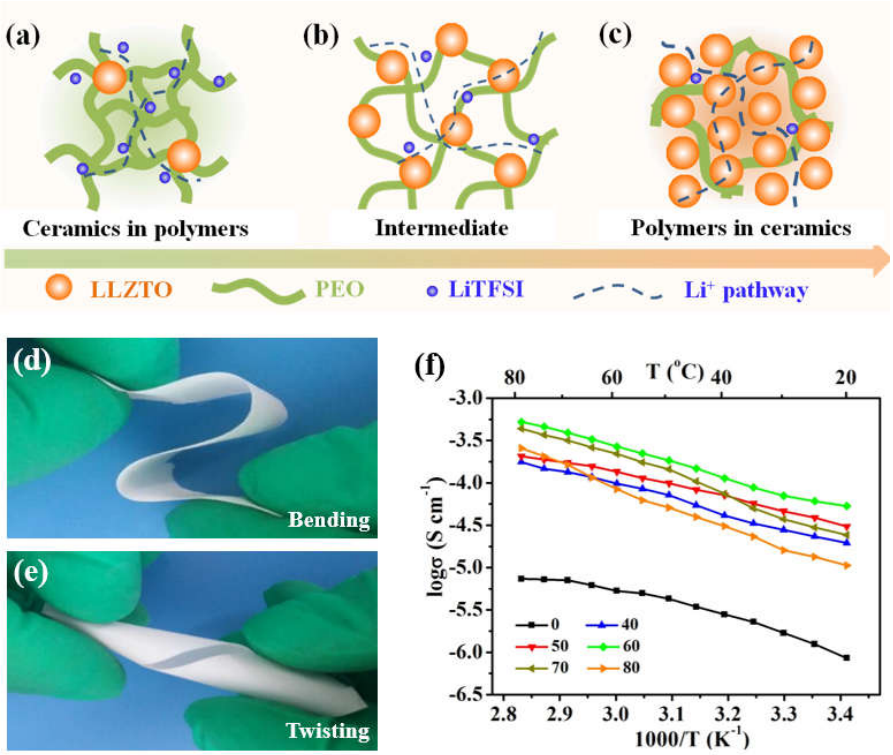

Figure 1. Schematic illustration: (a) "ceramic–in–polymer"; (b) "intermediate"; (c) "polymer–in–ceramic", (d-e) photograph to show the flexible and bendable property and (f) temperature dependent ionic conductivities of composite polyethylene-oxide/garnet electrolytes.

References:

[1] L. Chen, Y. Li, S. P. Li, L. Z. Fan, C.–W. Nan, J. B. Goodenough. Nano energy. 2018, DOI: 10.1016/j.nanoen.2017.12.037.