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Metal organic framework laden poly(ethylene oxide) based composite electrolytes for all-solid-state Li-S and Li-metal polymer batteries

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Abstract

In this work, the possibility of employing aluminium terephthalic acid metal organic framework (Al-TPA-MOF)-laden composite polymer membranes as electrolyte for all solid-state-lithium-sulfur (Li-S) and lithium-metal (Li-metal) polymer batteries is explored. The prepared composite polymer electrolytes (CPEs) based on a poly(ethylene oxide) (PEO) network with lithium bis(trifluoromethane)sulfonimide (LiTFSI) and Al-TPA-MOF are mechanically robust and thermally stable up to 270 °C, and provide appreciable ionic conductivity in the order of 0.1 mS cm^{-1} at 60 °C. The enhanced compatibility of CPEs with the lithium metal anode is attributed to the scavenging effect of Al-TPA-MOF. Laboratory scale all-solid-state Li-S and Li-metal polymer cells are assembled, which deliver specific capacities exceeding 800 and 130 mAh g^{-1}, respectively, and a stable performance upon prolonged cycling even at 60 °C, which is superior to earlier reports on similar systems.

Keywords: Lithium-sulfur battery; Lithium-polymer battery; Polymer electrolyte; Poly(ethylene oxide); Metal organic framework.