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Stabilizing the Li/Li1.3Al0.3Ti1.7(PO4)3 interface by introducing an ultrathin single-ion conducting interlayer

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Lithium metal is considered as one of the most promising anode candidates for high-energy batteries [1]. However, safety concerns induced by the formation of Li dendrites and the high reactivity at the electrode/electrolyte, resulting in a continuous electrolyte decomposition hinder the practical application [2]. It is anticipated that the use of non-flammable inorganic solid-state electrolytes can resolve these safety issues, but solid ceramic electrolytes generally suffer from poor physical contact with the electrode and poor electro-/chemical stability.
Herein, we report on a thin and flexible hybrid electrolyte composed of NASICON-type Li1.3Al0.3Ti1.7(PO4)3 (LATP), a polymer binder, and a small amount of an ionic liquid. To reinforce the interfacial stability between LATP and Li, we coat an ultrathin single-ion conducting polymer on the Li metal surface. The implementation of this interlayer enables a substantial extension of the cycle life of symmetric Li//Li cells and Li//NCM88 full-cells as the positive electrode active material. The superior performance achieved herein is mainly attributed to: (1) the prevented direct contact between LATP and Li; (2) the regulated Li+ flux at the electrode/electrolyte interface; and (3) the promoted intimate contact between PSiO and Li via the formation of Si–O–Li bonds.

References
[1] B. Horstmann et al., Energy Environ. Sci., 14 (2021) 5289-5314.
[3] X. He et al., Nat. Rev. Mater. 6 (2021) 1036–1052.

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