5 - 23 A COF-modified Polyimide Ion Track-etched Separator for Lithium-ion Batteries

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Enhancing the thermal stability of separator is the main strategy for improving the safety of lithium-ion batteries (LIBs) against thermal runaway. We successfully developed a roll-to-roll process to fabricate a COF (covalent organic framework)-modified polyimide (PI) ion track-etched separator by combining heavy ion track etching and doctor blade coating to achieve highly safe LIBs(Fig. 1). The COF-modified polyimide separator displays good electrolyte wettability, high mechanical strength and excellent thermal stability, as well as good electrochemical performance when applied in LIBs. Specifically, PI track etching membranes (TEMs) have been used to prepare separators with rigid structures and functional groups in polymer chains, thereby enabling the separators to be stable at temperatures up to 500 ℃. Moreover, coated COF nanoparticles with large pore diameter enhance interface compatibility to facilitate the conduction of lithium ions and suppressing the growth of lithium dendrites. Lithium iron phosphate/lithium cells with the COF-modified polyimide separator deliver better rate capability and superior capacity retention. The COF-modified polyimide separator is a promising candidate to achieve highly safe LIBs, and this work paves the way for engineering roll-to-roll techniques to suppress thermal runaway and improve battery safety.

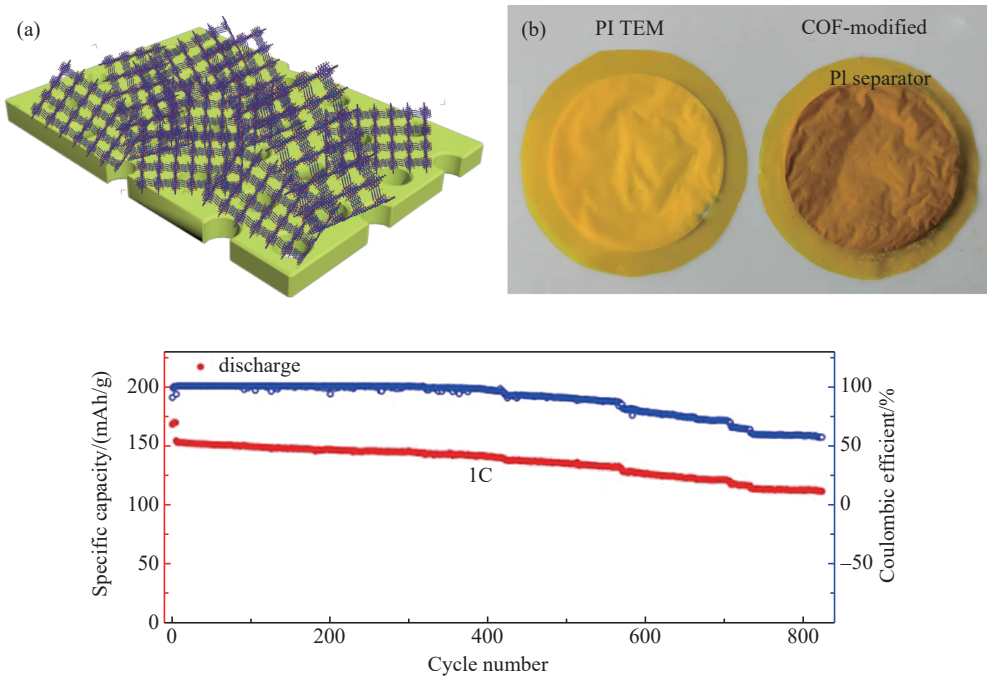

Fig. 1 (color online) (a) Schematic illustration showing the COF-modified polyimide separator, (b) Photographs of the PI TEM and COF-modified polyimide separator, (c) Galvanostatic discharge-charge curves at a charge current density of 1C (1C = 170 mAh/g).