Li₄Ti₅O₁₂/LiFePO₄ Solid-State Lithium-Ion Full Cell with LithiatedNafion membrane

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The present work studies the solid-state lithium-ion full cell Li₄Ti₅O₁₂/LiFePO₄ with propylene carbonate swollen lithiated Nafion membrane (Li-Nafion) as both electrolyte and separator, and lithiated Nafion dispersion – as a binder. The advantage of this cell is single-ion lithium conductivity of the polymer electrolyte preventing its polarisation, as well as the absence of a liquid phase and negligible vapour pressure of the high-boiling-point plasticiser increasing the safety of the device. The galvanostatic charge/discharge tests examined the electrochemical performance of the full cell, as well as Li/Li₄Ti₅O₁₂ and Li/LiFePO₄ half-cells. With a commonly used mass ratio of composite electrodes (active material/carbon black/binder of 80:10:10), the discharge capacity of the full cell Li₄Ti₅O₁₂/Li-Nafion/LiFePO₄ as studied for the first time was about 70 mAh g⁻¹ at 50th charge-discharge cycle at coulombic efficiency of 99%. A more proper plasticiser and optimisation of the mass ratio of the components of the electrodes can render such a cell suitable for application in LIBs with enhanced safety.

Keywords: Lithium-ion battery; Electrochemical performance; LithiatedNafion; Lithium iron phosphate; Lithium titanate

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