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Design of a porous gel polymer electrolyte for sodium ion batteries

Jin Il Kim[a], Kyung Yoon Chung[b], Jong Hyeok Park[a,*]

[a] Department of Chemical and Biomolecular Engineering, Yonsei University, 50 Yonseiro, Seodaemun-gu, Seoul 120-749, Republic of Korea

[b] Center for Energy Convergence Research, Korea Institute of Science and Technology, Hwarang-ro 14-gil 5, Seongbuk-gu, Seoul 136-791, Republic of Korea

* *Corresponding author. E-mail address*: lutts@yonsei.ac.kr (J. H. Park)

A B S T R A C T

A separator is essential component for securing the safety and stability of secondary batteries. Sodium ion batteries (SIBs) have been considered as a highly powerful next generation energy storage device, but the conventionally used glass fibre (GF) separators for SIBs do not meet the necessary standards due to their randomly distributed pore structure, which causes severe safety problems and capacity decay. Although many studies have been performed to address these drawbacks, there are still difficulties of controlling the inner pore structure of GF. Herein, a strategy is introduced to control the inner porous nanostructure of GF via non-solvent induced phase separation (NIPS) engineering for the gel-polymer electrolyte in SIBs. We report how different types of porous polymer gel electrolyte inside the GF matrix affect SIB performance in terms of both pore nanostructure and vertical position of polymer layer. As a result of NIPS, the optimized gel-polymer electrolyte in GF facilitates increased ionic conductivity via modified ion transport and displays superior cell characteristics with excellent stability.

Graphical abstract

Gel polymer electrolyte with controlled morphology for sodium ion battery exhibits excellent cell characteristic for various current density and long-term cycle, resulting from effective inside pore structure and enhanced compatibility with electrodes.