Supporting Information

Boehmite-modified solid electrolytes with different grain size for stable lithium metal batteries

Weiran Zhao, Peng Tian*, Tingting Gao, Wu Wang, Chenxi Mu, Hongchang Pang,

Junwei Ye, Guiling Ning**

a Dalian University of Technology-Baohong Technology Lithium Battery New Materials Joint

Research Center, School of Chemical Engineering, Dalian University of Technology, Dalian

116024, Liaoning, PR China

b Innovation Institute, Jiangxi Baohong Nanotechnology Co Ltd, Yichun, 336000, Jiangxi, PR

China

*Corresponding author. Email: tianpeng@dlut.edu.cn

**Corresponding author. Email:ninggl@dlut.edu.cn



Figure S1. Characterizations of pseudo-boehmite particles: (a) TEM image; (b)

XRD pattern



Figure S2. SEM images of different boehmite particles: (a)BM₀, (b)BM₂₀₀, (c)BM₂₂₀,

(d)BM240, (e)BM260, and (f)BM280.



Figure S3. Nitrogen adsorption and desorption isotherms of (a)BM, (b) BM₂₀₀, (c)

BM₂₂₀, (d) BM₂₄₀, (e) BM₂₆₀, and (f) BM₂₈₀.



Figure S4. Solution images of (a) PEO; (b) BM/PEO and (c) (d) Photographs of

a flexible BM/PEO electrolyte, which was subjected to

extreme deformation test.

(a)	(b)	(c)
<u>500nm</u>	<u>500nm</u>	<u>500nm</u>
(d)	(e)	(f)
<u>500nm</u>	<u>500nm</u>	<u>500nm</u>

Figure S5. SEM images of: (a) PEO, (b)BPE0, (c)BPE200, (d)BPE220, (e)BPE240, and

(f)BPE₂₆₀.



Figure S6. EDS spectra of: (a) BPE_{200} , (b) BPE_{220} , (c) BPE_{240} , (d) BPE_{260} , and

(e)BPE₂₈₀



Figure S7. Full-range FTIR spectra of (a) PEO, (b) BPE₂₀₀, (c) BPE₂₂₀, (d)



BPE240, (e) BPE260 and (f) BPE280.

Figure S8. XRD spectra of (a) PEO, (b) BPE200, (c) BPE220, (d) BPE240, (e)

BPE₂₆₀ and (f) BPE₂₈₀.



Figure S9. TG curves under a N2 atmosphere of BM200, BM220, BM240, BM260,

and BM₂₈₀.



Figure S10. Electrochemical performance of solid electrolytes introducing different amounts of boehmite as a ratio of PEO at 60°C: (a) Nyquist plots;

(b)Aggregate trends in the ionic conductivity.



Figure S11. Chronoamperometry profile and Nyquist impedance spectra before and after polarization of the assembled lithium symmetric cells using (a) PEO, (b)

BPE200, (c) BPE220, (d) BPE240, (e) BPE260 and (f) BPE280.



Figure S12. (a) XRD patterns of boehmite synthesized with different crystal species ratios; electrochemical performance of solid electrolytes introducing different boehmite of PEO at 60°C: (b) Nyquist plots; (c)Aggregate trends in the ionic conductivity.



Figure S13. The voltage profiles at different cycle numbers: (a) LFP/PEO/Li; (b)

LFP/BPE₂₀₀/Li; (c) LFP/BPE₂₂₀/Li; (d) LFP/BPE₂₄₀/Li; (e) LFP/BPE₂₆₀/Li and (f)

LFP/BPE280/Li.



Figure S14. voltage profiles of Li|Li symmetrical cells at a current density of 0.1 mA/cm² with a capacity density of 0.1 mAh/cm²: (a) Li/PEO/Li; (b) Li/BPE₂₀₀/Li; (c)

Li/BPE₂₂₀/Li; (d) Li/BPE₂₄₀/Li; (e) Li/BPE₂₆₀/Li and (f) Li/BPE₂₈₀/Li.



Figure S15. surface-section images of lithium plates disassembled from symmetrical batteries after 100 cycling of (a) Li/PEO/Li; (b) Li/BPE₂₀₀/Li; (c) Li/BPE₂₂₀/Li; (d)

Li/BPE₂₄₀/Li; (e) Li/BPE₂₆₀/Li and (f) Li/BPE₂₈₀/Li.