ARTICLE

Electronic supplementary information

Platinum Nano-Interlayer Enhanced Interface for Stable All-Solid-State Batteries Observed via Cryo-Transmission Electron Microscopy

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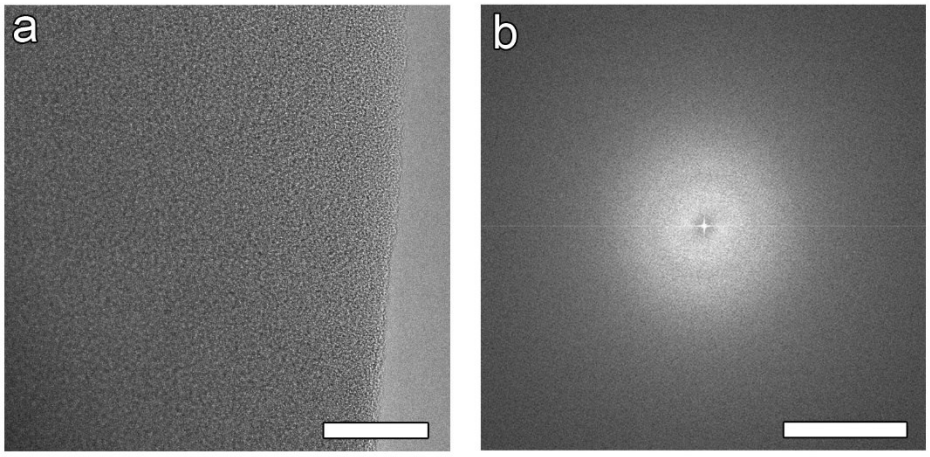

Fig. S1 (a) The HRTEM image of pure PEO based electrolyte. (b) The corresponding FFT of (a). Scale bar: (a) 20 nm, (b) 5 nm^{-1}.

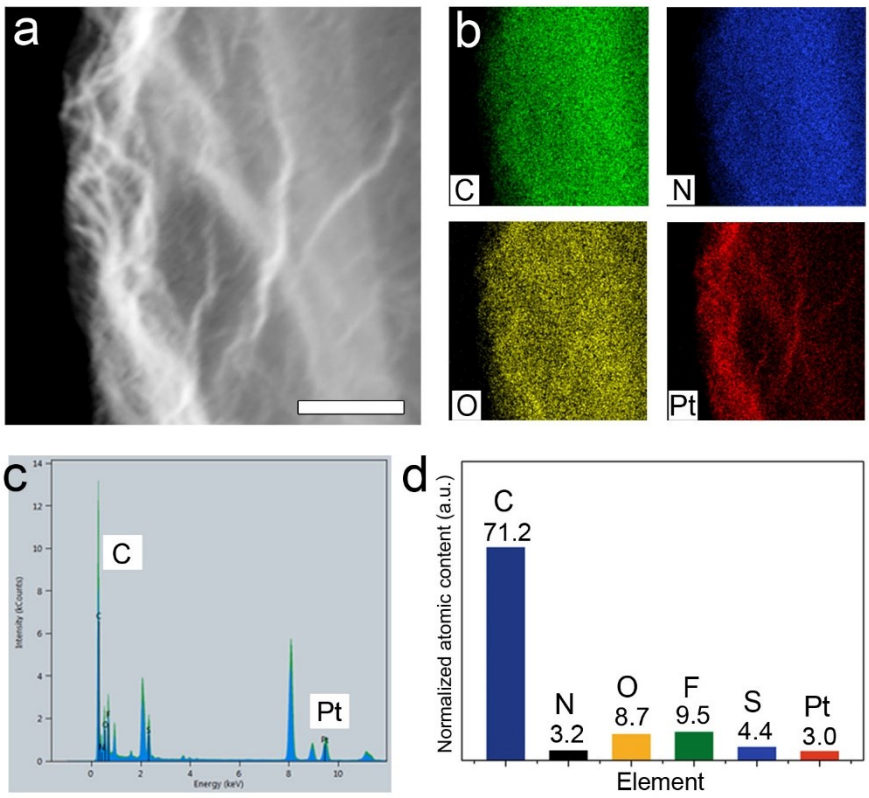

Fig. S2 (a) The STEM image of Pt modified electrolyte. (b) The corresponding distribution of C, O, N and Pt elements. (c) The intensity spectrum of C, N, O, F, S, Cu and Pt elements. (d) The corresponding atomic content. Scale bar: (a) 50 nm.

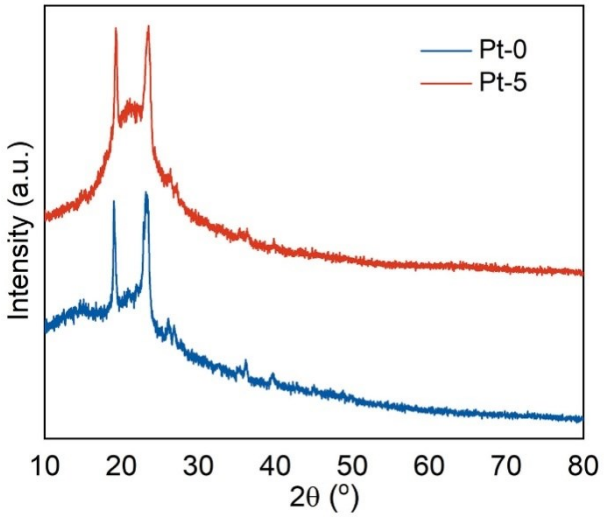

Fig. S3 XRD pattern of PEO electrolyte surface after circulation.

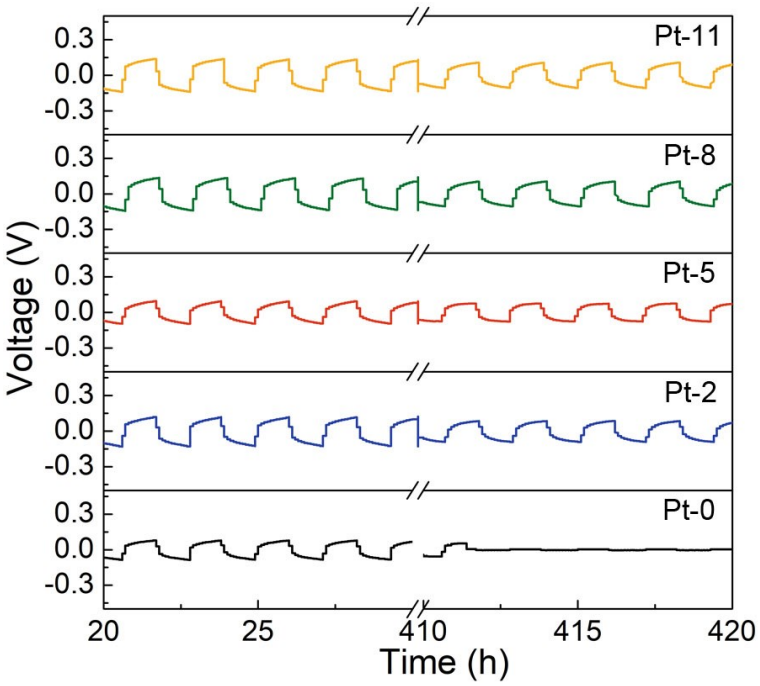

Fig. S4 Local enlarged voltage profiles of the lithium (Li)-Li cells with Pt-0, Pt-2, Pt-5, Pt-8 and Pt-11 electrolytes at 0.1 mA cm^{-2} under 50 ^{o}C.

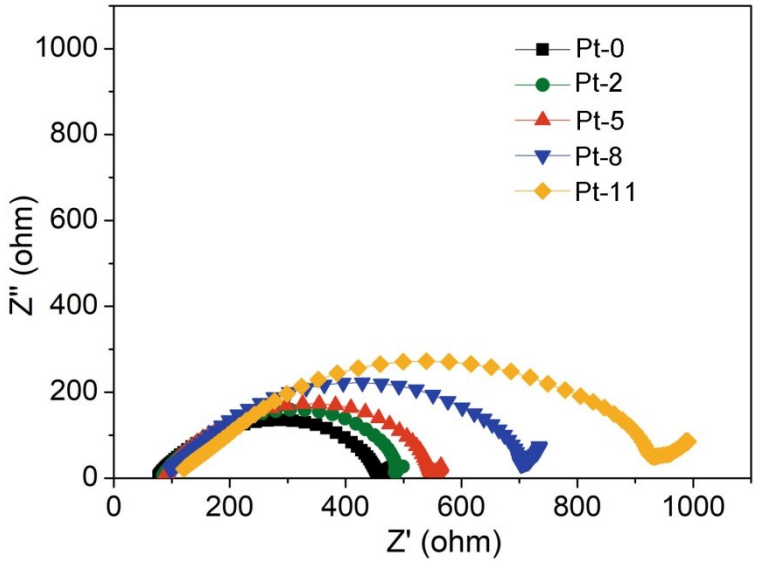

Fig. S5 The impedance variation of Li-Li cell using different electrolyte before cycle.

When sputtering 2, 5, 8, and 11 nm Pt on SPE surface, the impedance of Li/PEO interface is 400, 470, 600, and 800 Ω, respectively.

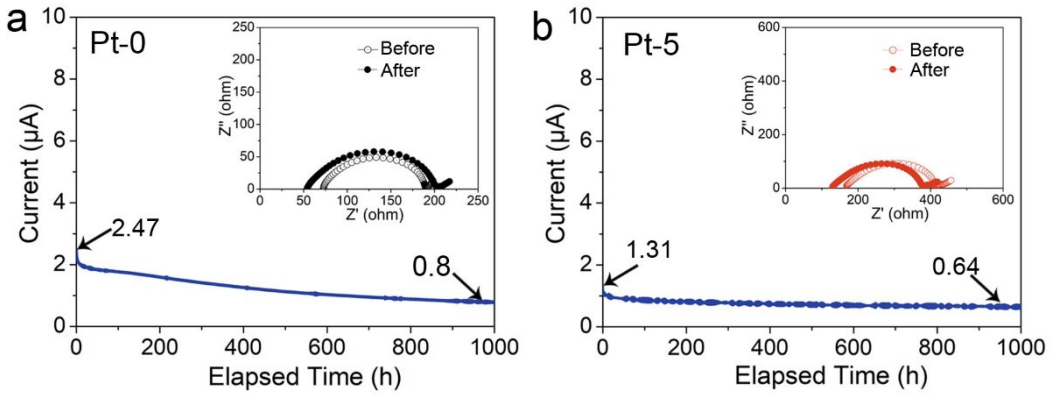

Fig. S6 (a, b) Chronoamperometry of the (a) Li/Pt-0/Li and (b) Li/Pt-5/Li cells. Insets: the impedance spectra of the same cell before and after polarization.

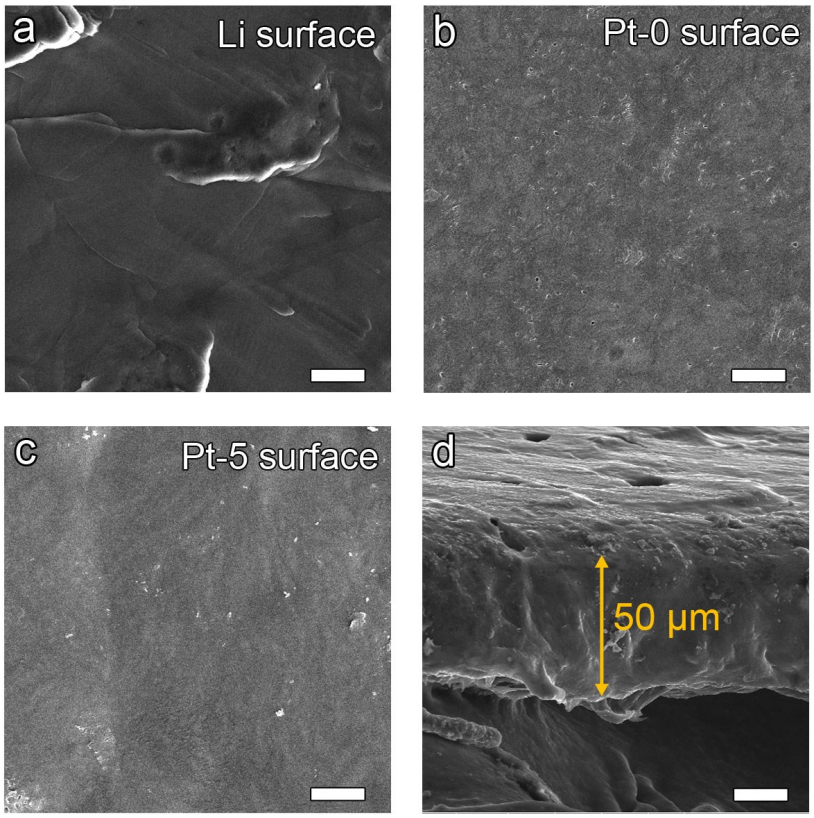

Fig. S7 (a) SEM image of fresh Li metal before cycling. (b, c) SEM images of (b) Pt-0 electrolyte and (c) Pt-5 electrolyte before cycling. (d) Cross-sectional SEM image of the Pt-5 electrolyte where the thickness of SPE was indexed. Scale bar: (a-d) 20 μm.

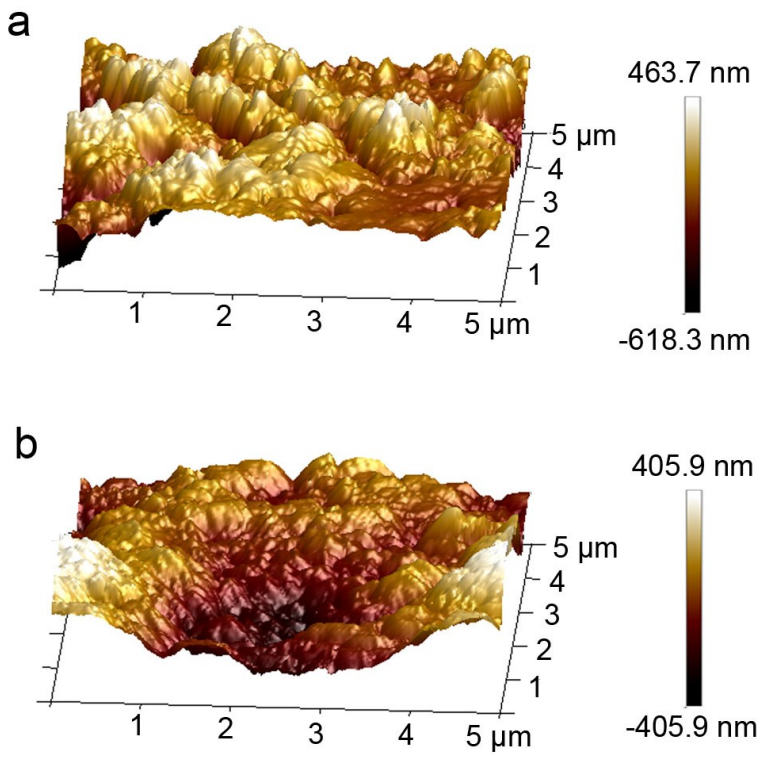

Fig. S8 AFM height images of Li metal surface with (a) Pt-0 electrolyte and (b) Pt-5 electrolyte after 100 cycles.

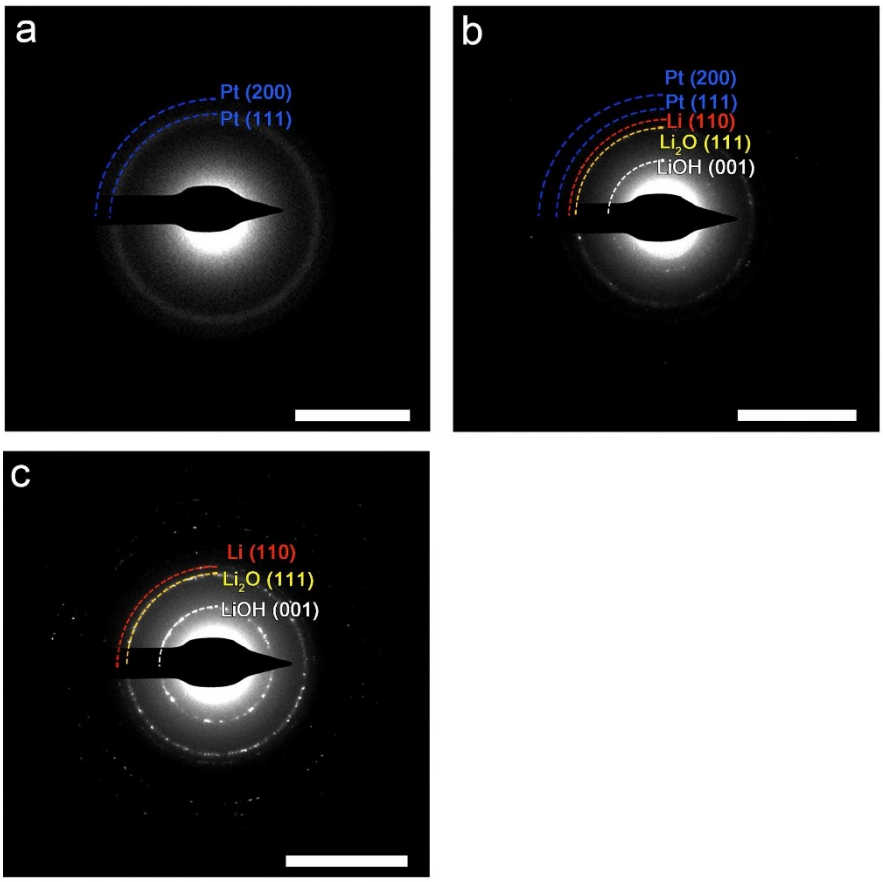

Fig. S9 Selective area electron diffraction (SAED) patterns of (a) Pt-5 electrolyte before Li deposition, (b, c) Pt-5 electrolyte after Li deposition. Scale bars, 5 nm^{-1}. Green circle: Pt, 1.98, 2.29 Å, Red circle: Li, 2.48 Å, yellow circle: Li_2O, 2.66 Å, white circle: LiOH, 4.35 Å.

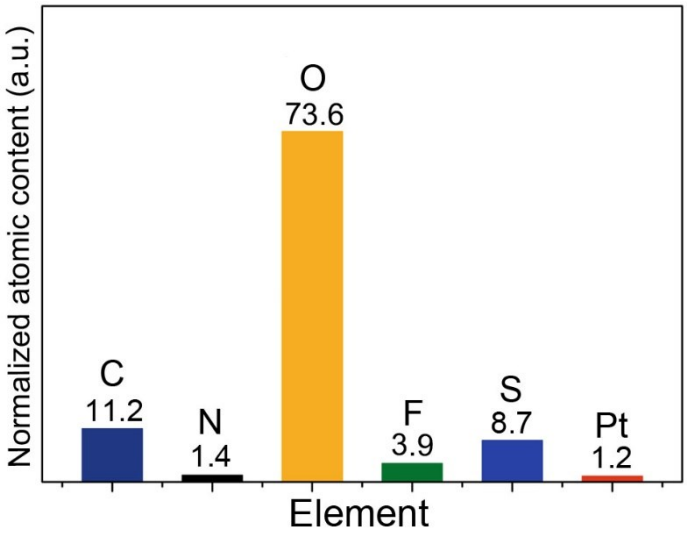

Fig. S10 The atomic content of C, N, O, F, S and Pt elements after Li deposition using Pt-5 electrolyte.

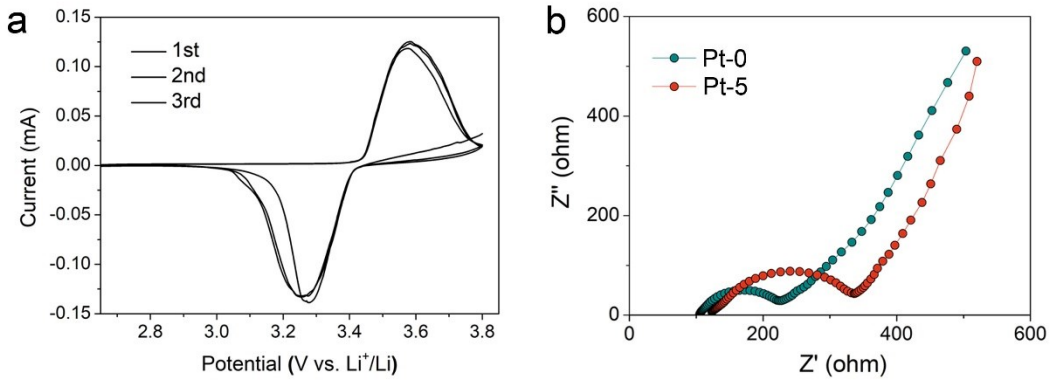

Fig. S11 (a) CV curves of the $LiFePO_4$ full cell using the Pt-5 electrolyte in the voltage of 2.6-3.8 V at 50 °C. (b) EIS spectra of different ASSLMBs before cycling.

Table S1 Electrochemical properties for Li-Li half-cells and Li-$LiFePO_4$ full-cells using different electrolyte in the recent years.

Electrolyte	**Working Temp.**	**Li-Li cell**	**Li-$LiFePO_4$ cell**	**Year**	**Ref.**
PI/PEO/LiTFSI	60 °C	1000 h (0.1 mA cm^{-2})	138 mAh g^{-1} (0.5 C) 300 th	2019	[1]
PEO/CQDs-Li	60 °C	120 h ($0.05, 0.1$ mA cm^{-2})	120 mAh g^{-1} (4 C) 97.1% (200 th)	2018	[2]
IPN9-10PPC	90 °C	300 h (1.5 mA cm^{-2})	141.5 mAh g^{-1} (0.2 C) 92.7% (200 th)	2020	[3]
PEO-TEGDME-TEGDMA	25 °C	400 h (0.05 mA cm^{-2})	140 mAh g^{-1} (0.1 C) 98.8% (100 th)	2019	[4]
LiEFA/PEO	70 °C	250 h (0.1 mA cm^{-2})	130 mAh g^{-1} (C/3) 25 th	2019	[5]
LiFSI/FPE+LiFSI/PEO	70 °C	1000 h (0.1 mA cm^{-2})	130 mAh g^{-1} (0.2 C) 200 th	2019	[6]
Pt-5	**50 °C**	**2000 h (0.1 mA cm^{-2})**	**150 mAh g^{-1} (0.5 C) 98% (270 th)**		**In this work**

References

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