Electronic Supplementary Material (ESI) for RSC advances

Elevated Electrochemical Performances Enabled by Core-Shell Titanium Hydride Coated Separator in Lithium Sulphur Batteries

Zhiyuan Zhao, [a] Xiaobo Duan, *[a] Lei Zhang, [a] Zhiwei Che, [a] Kun Wang, [a] Bin zheng, *[a] Xiaogang Wang [a]

[a]Department of Materials Science & Engineering, Xi'an University of Science and Technology, Xi'an710054, china.

E-mail: xiaobo12558@163.com, zhengbin@xust.edu.cn

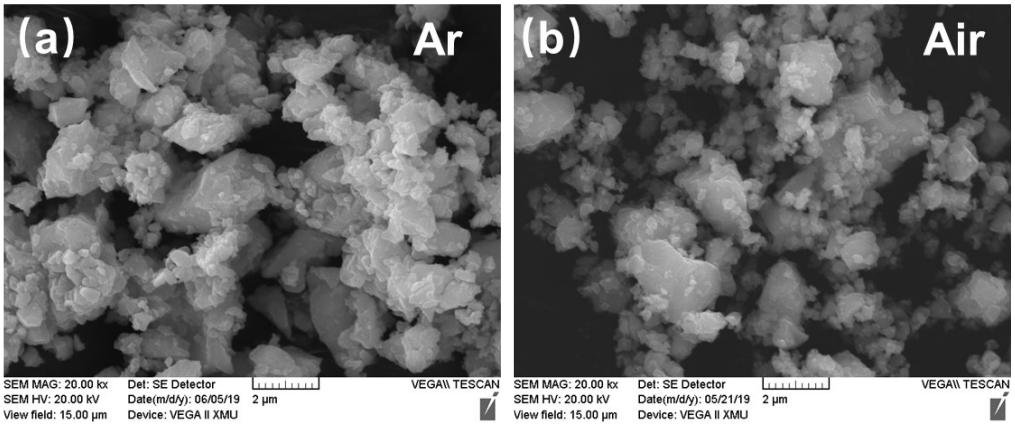

Figure S1 SEM images of the TiH_2 powder ball milled in Ar (a) and air (b)

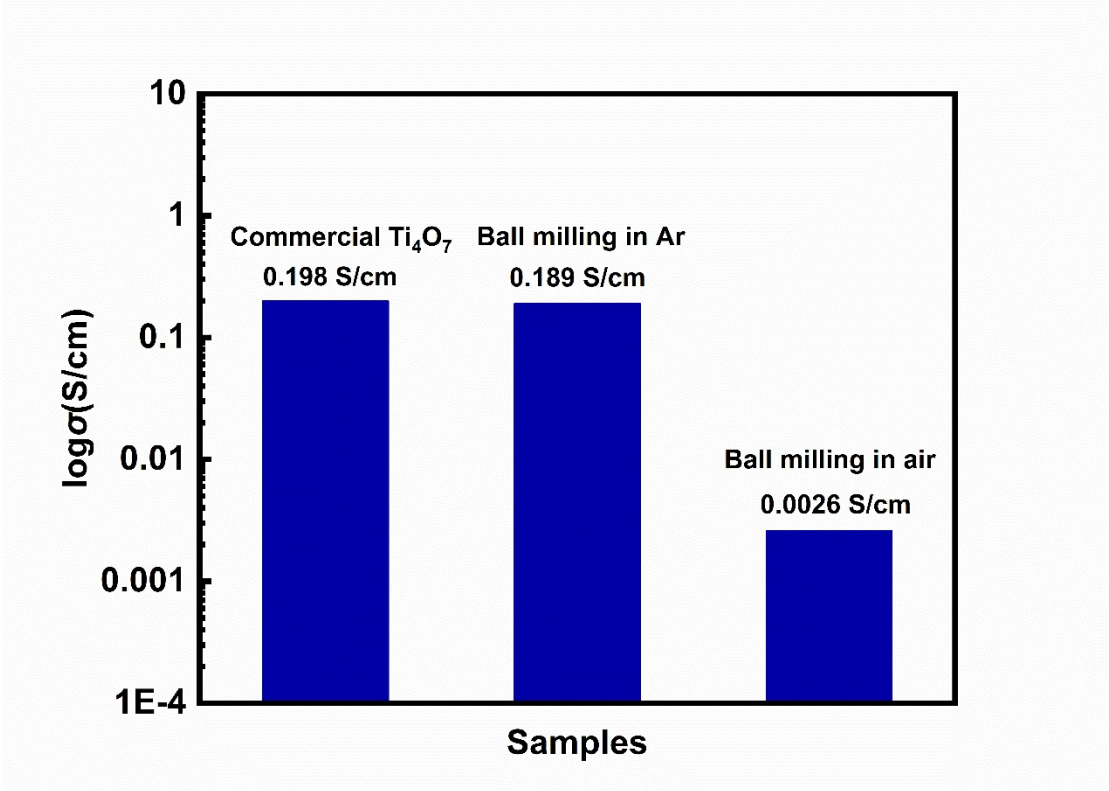

Figure S2 Electronic conductivities of the Ti_4O_7 powder ball milled in Ar or air

Table S1 Chemical composition of the TiH_2 samples and nano TiO_2 powder by XPS

element	Commercial TIH_2(at%)	TiH_2 balled in Ar (at%)	Nano TiO_2 (at%)
C 1s	42.65	23.73	16.74
Ti 2p	17.05	20.4	25.41
S 2p	0.37	0.38	0.31
O 1s	39.93	55.49	57.54

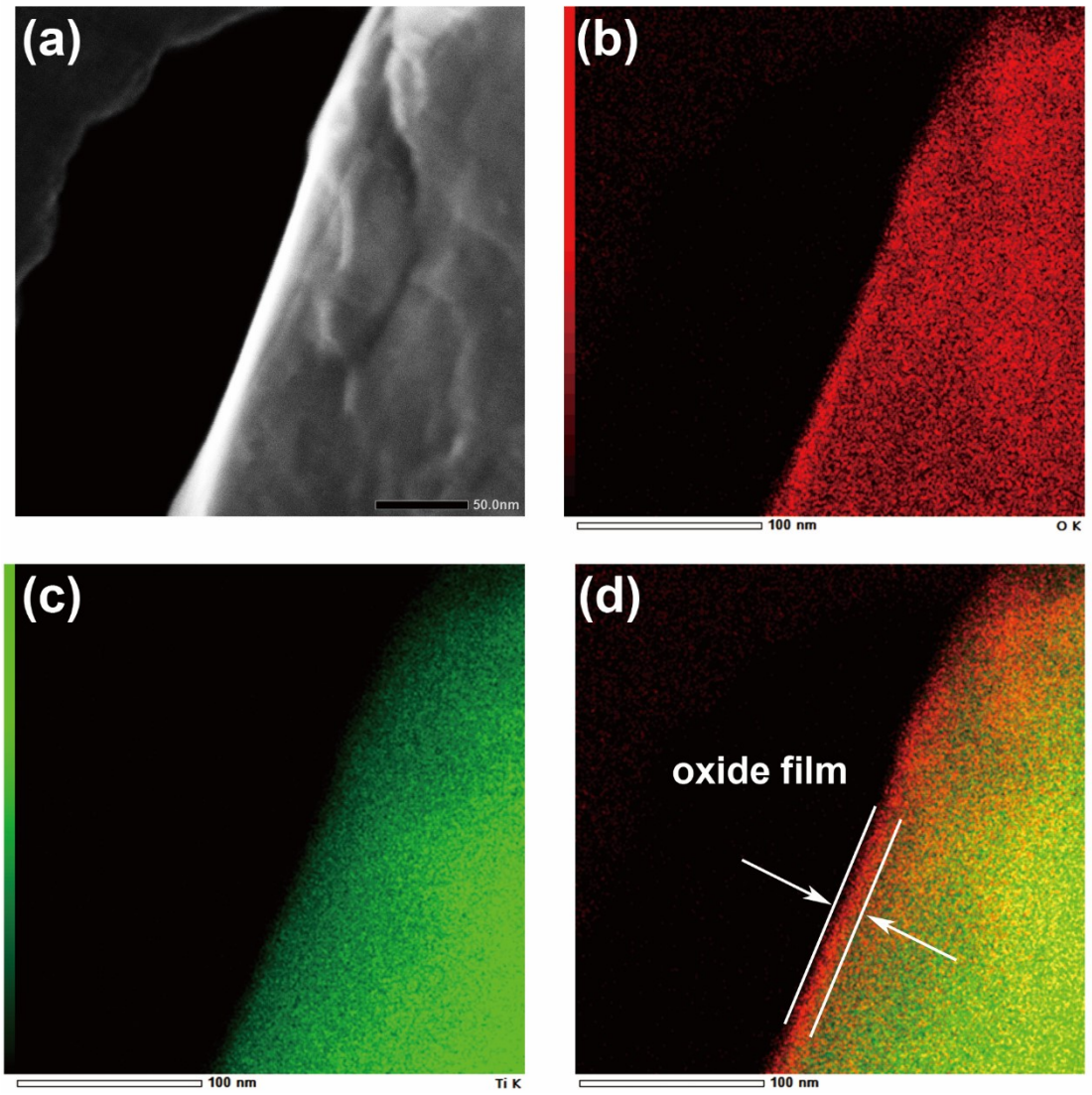

Figure S3 Element mappings of the edge of the TiH_2 powder. (a) TEM image, (b) O. (c) Ti, (d) O and Ti overlapped mapping

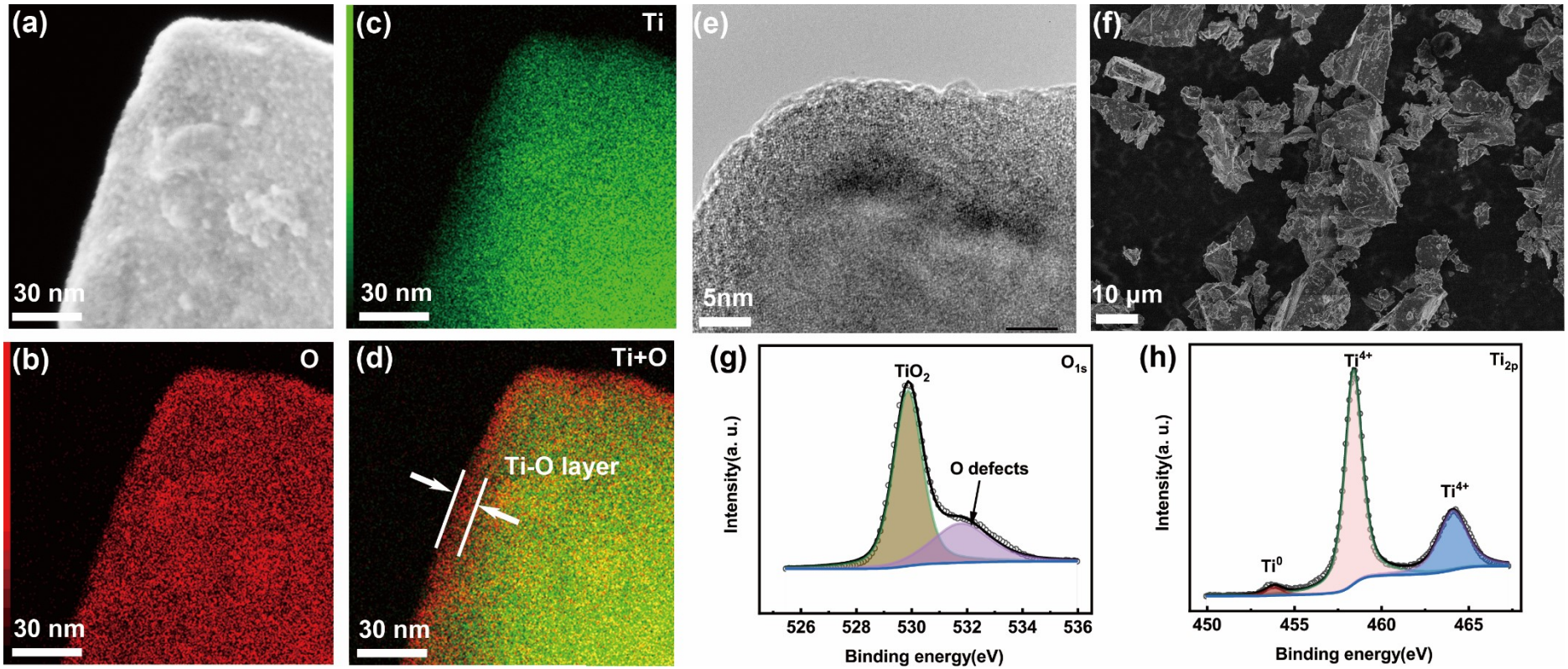

Figure S4 Microstructure and composition analysis of the commercialTiH_2 powder. (a) TEM image and the corresponding (b) Ti mapping. (c) O mapping, (d) O and Ti overlapped mapping. (e) HTEM image of the edge of the TiH_2 particles, (f) SEM image, (g) O 1s spectrum and (h) Ti 2p spectrum.

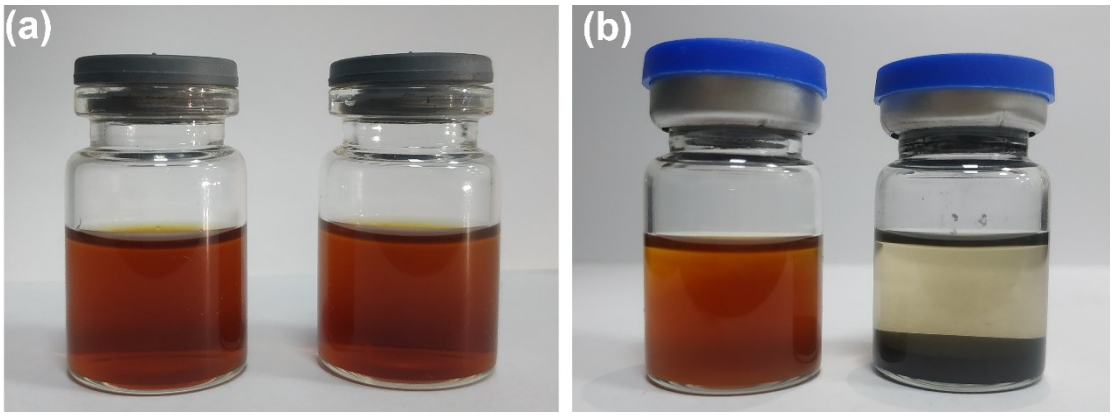

Figure S5 Photos of the polysulfide solution before (a) and (b) 10 min after the adding of the TiH_2 powder. The left penicillin bottle is the control sample.

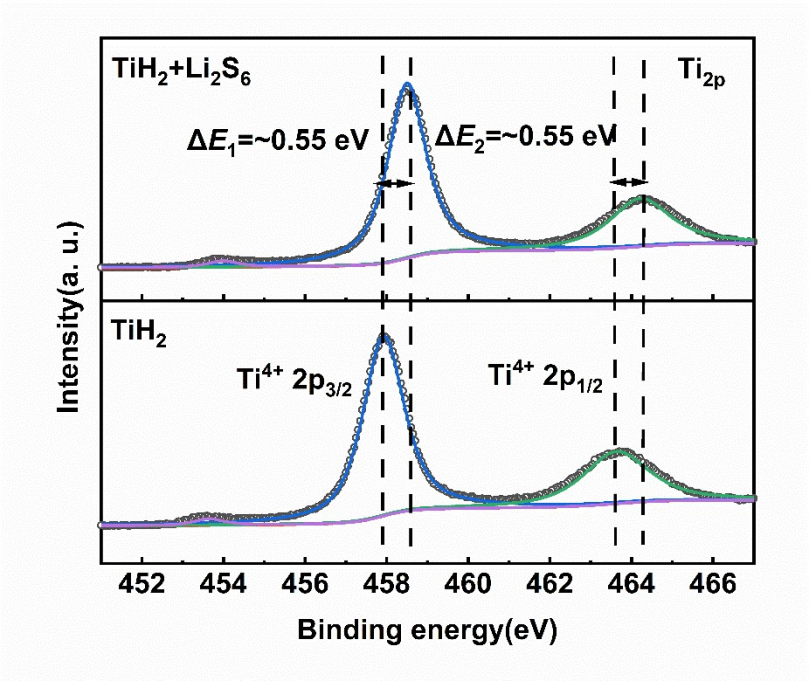

Figure S6 Ti 2p spectra of TiH_2 before and after soaked in Li_2S_6 solution

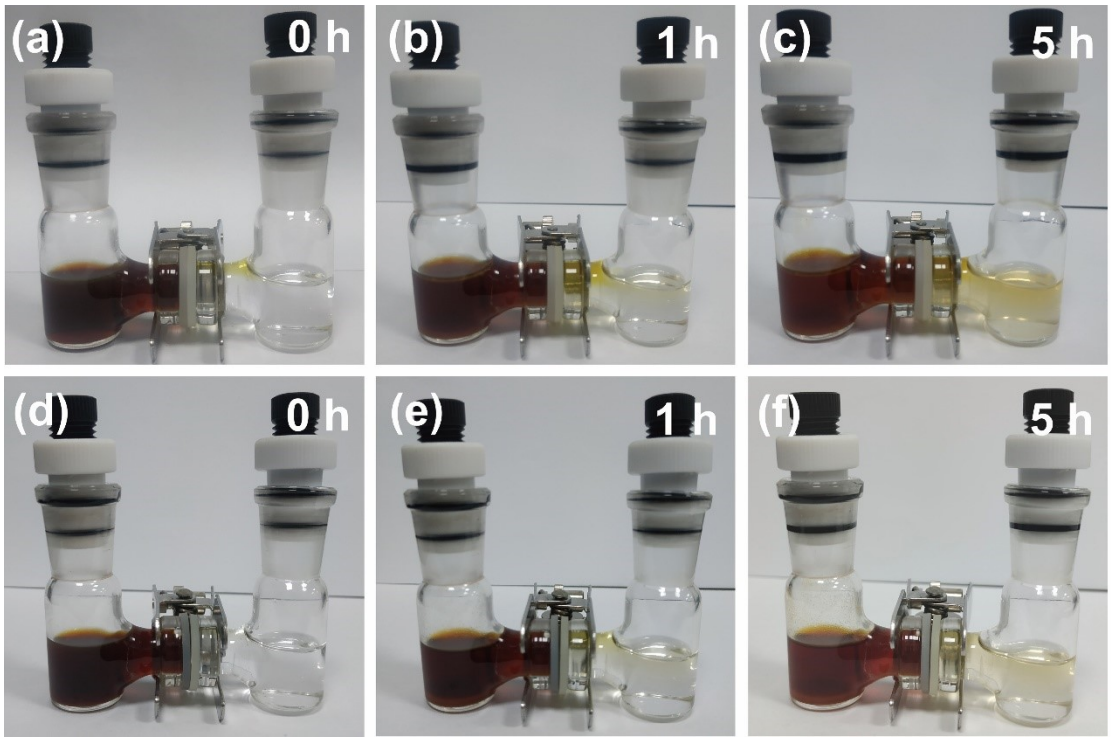

Figure S7 Visualized diffusion test of Celgard separator (a, b, c) and the TiH_2 separator (d, e, f).

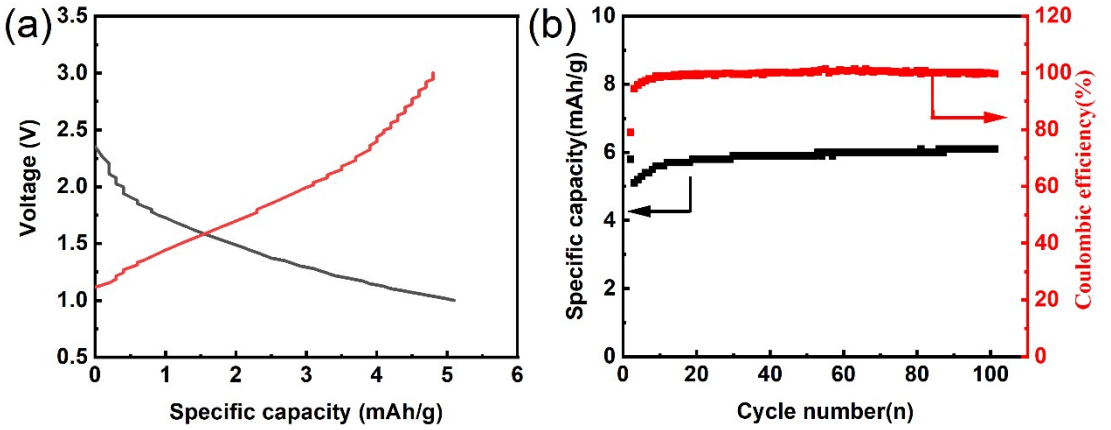

Figure S8 Electrochemical properties of milled TiH_2 powder in Ar. (a) Discharge/charge profiles. (b) Cycling performance and Coulombic efficiency

Table S2 Ionic conductivities and total resistances of the TiH_2 separator and Celgard separator

separator	Ionic conductivity (mS/cm)	Total resistance (Ω)
TiH_2 separator	0.74	3.65
Celgard separator	0.65	1.98

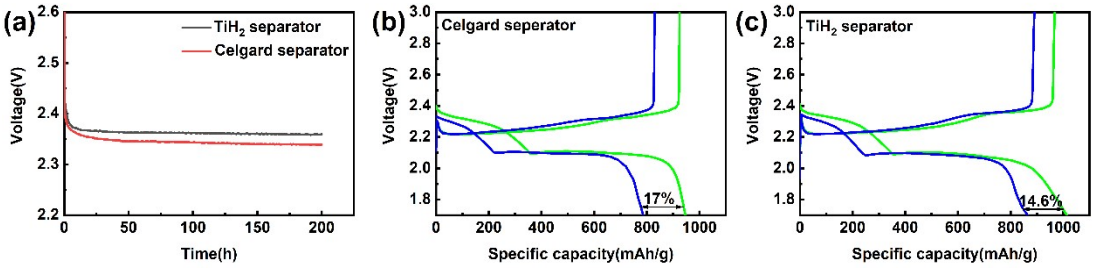

Figure S9 Self-discharge performances of the lithium sulfur batteries with different separators. (a) Open circuit voltage. Discharge/charge capacity loss of the lithium sulfur battery with the Celgard separator(b) and TiH_2 separator(c) after 200h.

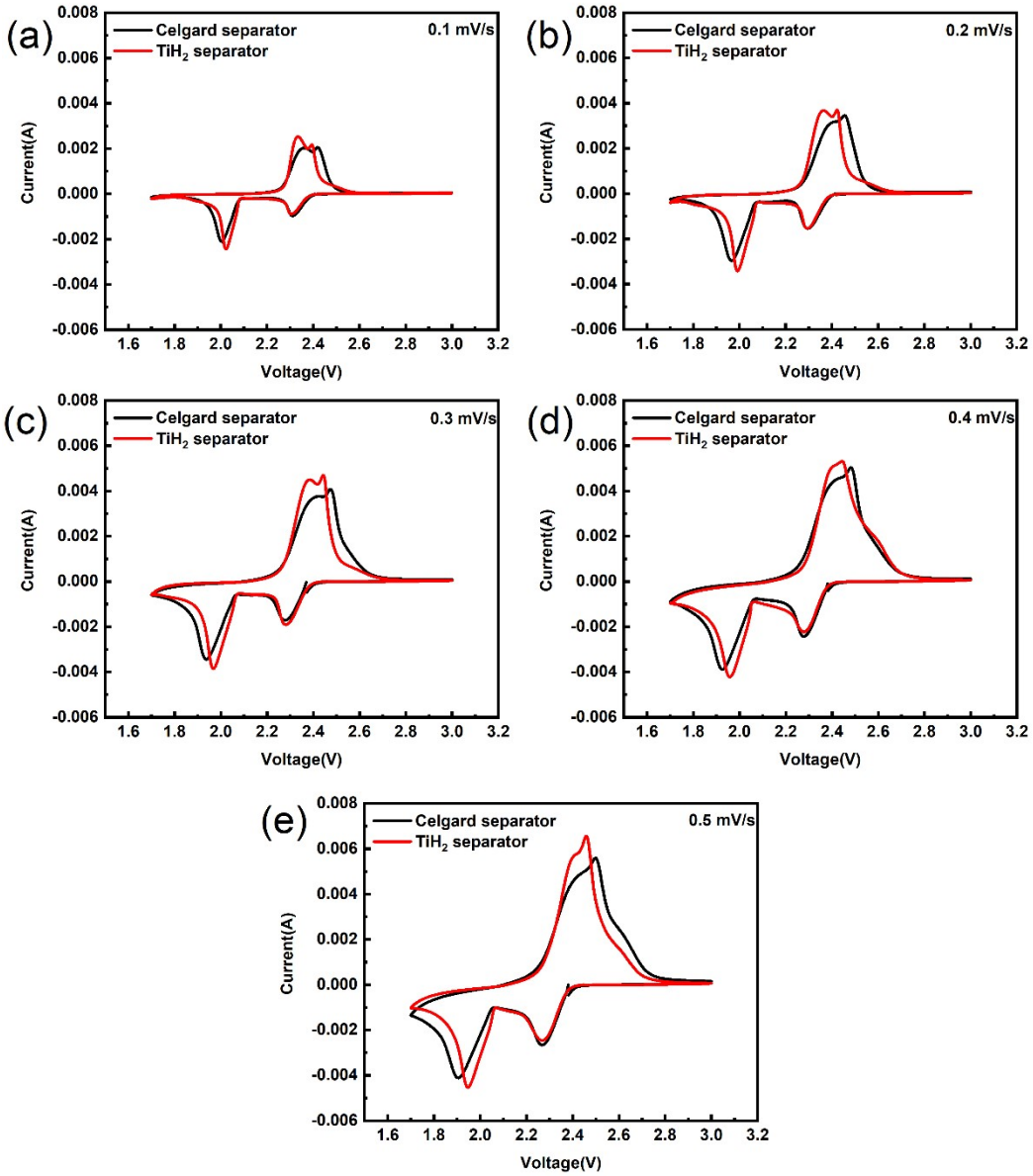

Figure S10 Cyclic voltammetry comparison of the lithium sulfur batteries with the Celgard separator and the TiH_2 separator. (a) 0.1 mV/s. (b) 0.2 mV/s. (c) 0.3 mV/s. (d) 0.4 mV/s. (e) 0.5 mV/s.

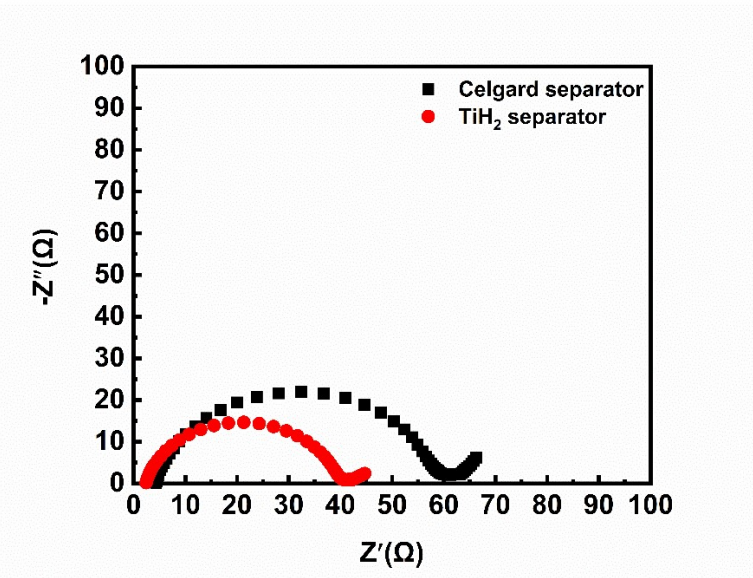

Figure S11 EIS of the lithium sulfur batteries with the Celgard separator and TiH_2 separator