Supplementary Information

Rice Husk–Derived Porous Silicon Dioxide Fillers for Enhancing Ionic Conductivity in a Solid-State Electrolyte of Lithium–Sulfur Batteries Under Molecular Dynamic Calculation

Jyun-Ting Lee[1, 2], Meng-Chin Lin[1], Chyi-Ming Leu[3], and Jyh Ming Wu[1,4*]

[1]Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu 300, Taiwan.

[2] Ph.D. Program in Prospective Functional Materials Industry, National Tsing Hua University, Hsinchu 300, Taiwan.

[3]Material and Chemical Research Laboratories, Industrial Technology Research Institute, Taiwan

[4]High Entropy Materials Center, National Tsing Hua University, Hsinchu 300, Taiwan.

*Correspondence to: wujm@mx.nthu.edu.tw(J.M.W.)

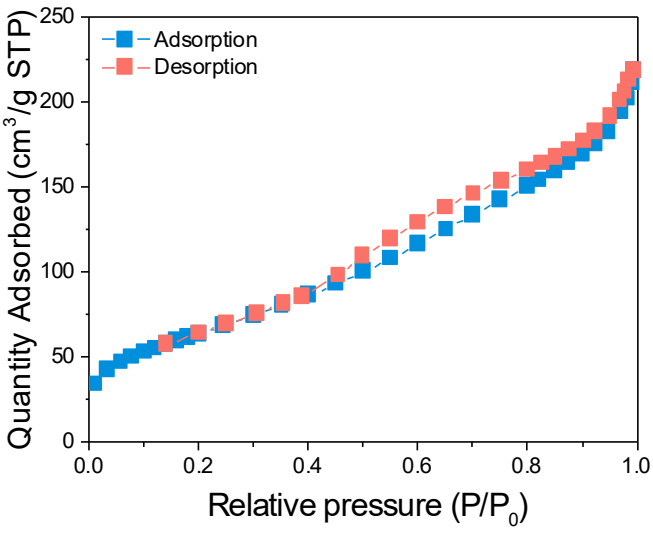


Fig. S1 The BET anaslysis of RH_{SiO2}.

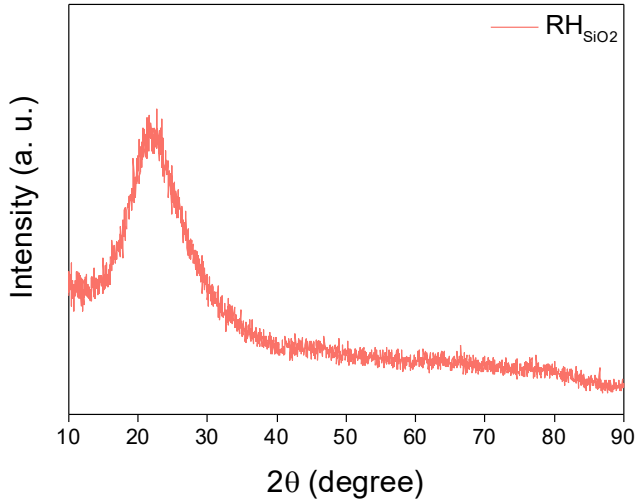
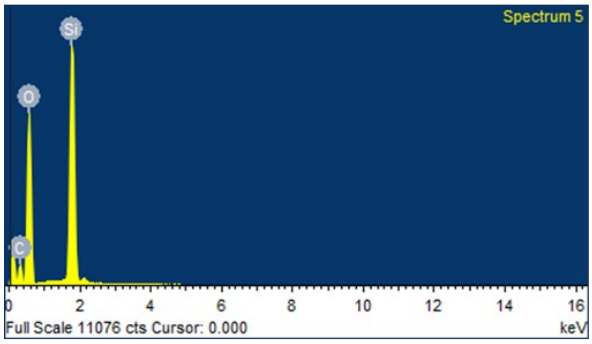


Fig. S2 The XRD analysis of RH_{SiO2}.



Element	Weight%	Atomic%
C K	17.00	23.95
O K	57.20	60.50
Si K	25.80	15.55
Totals	100.00	

Fig. S3 The EDX analysis of RH_{SiO2}.

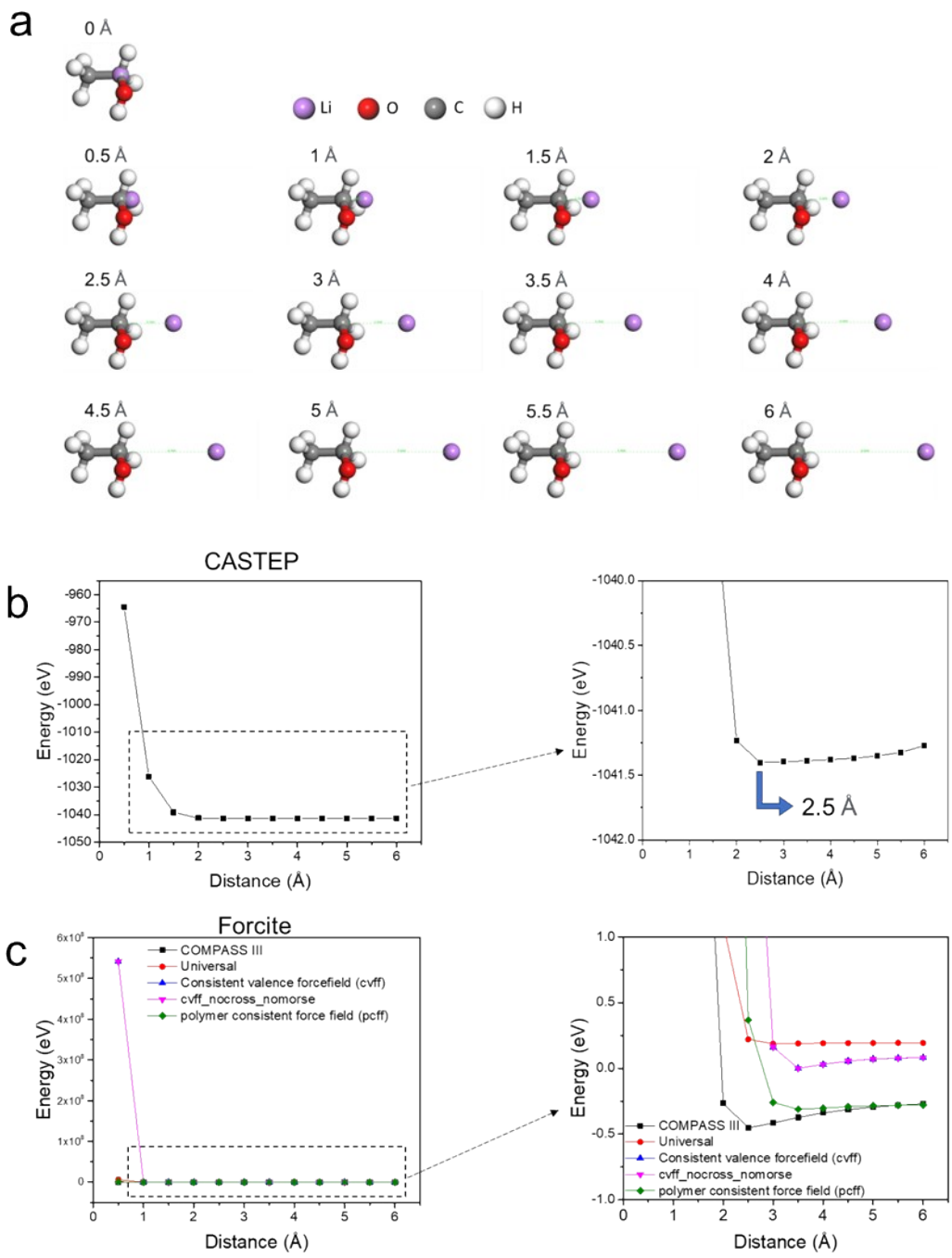


Fig. S4 (a) The calculation model of ethylene oxide monomer and Li-ion with various distances. The energy curve as a function of the distance by (b) CASTEP calculation and (c) Forcite calculation.

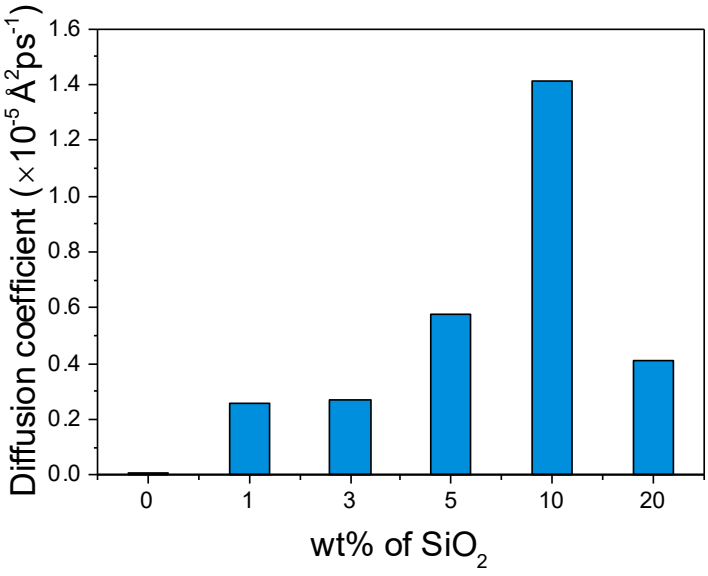


Fig. S5 The diffusion coefficients of CPEs with various content of RH_{SiO2} from the molecular dynamics simulation.

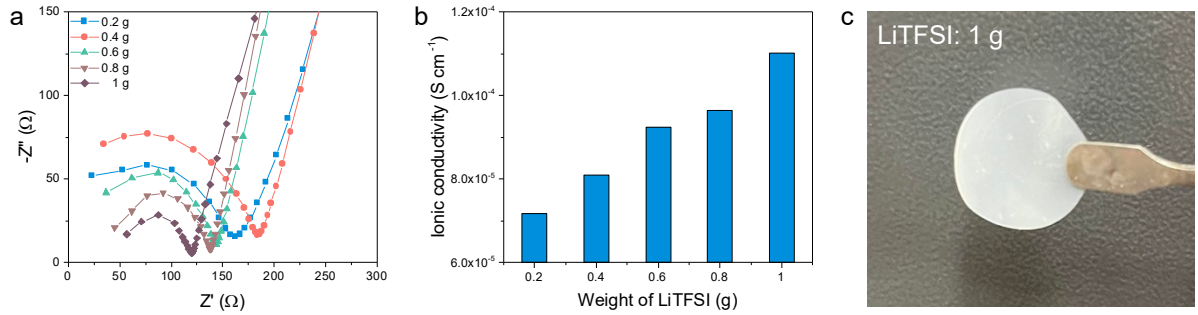


Fig. S6 (a) The EIS measurement and (b) the ionic conductivity of RH_{SiO2} CPE with the various weight of LiTFSI. (c) CPE film with 1 g LiTFSI.

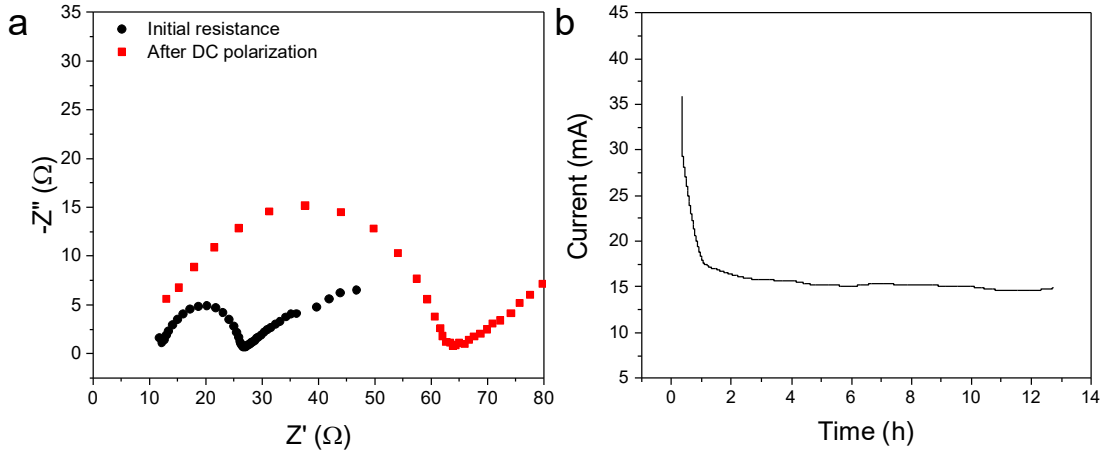


Fig. S7 (a) the AC impedance spectra of the Li/RH_{SiO2} CPE/Li cell from 10 mHz to 100 kHz before polarization and the steady-state has been reached. (b) Polarization curve of Li/RH_{SiO2} CPE/Li cell.

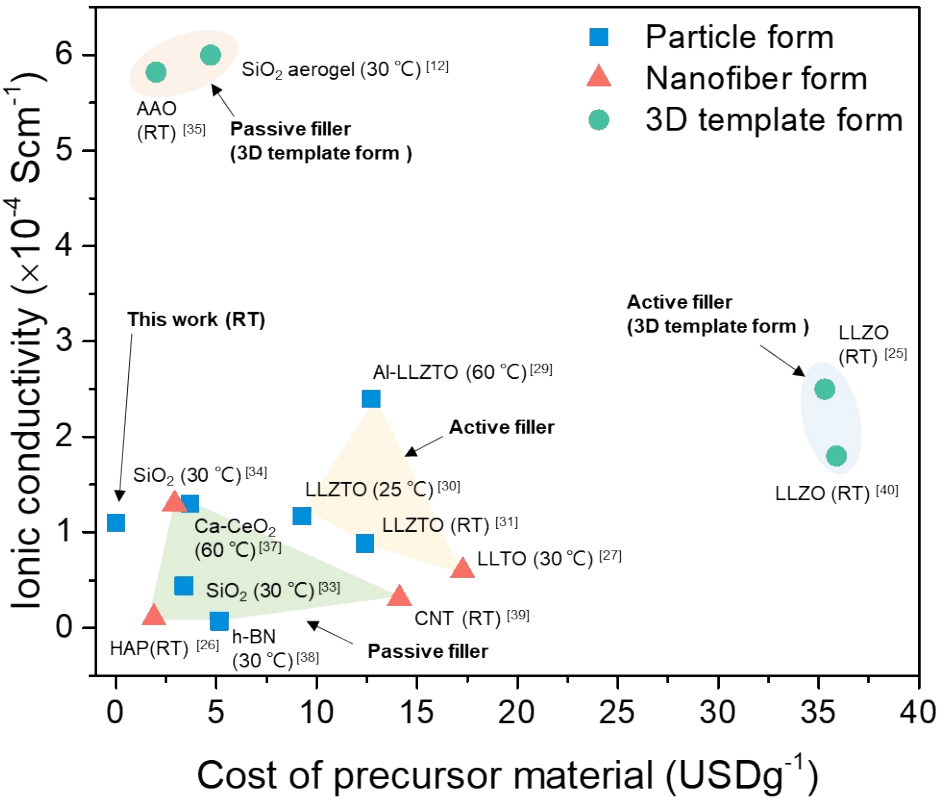


Fig. S8 The comparison of ionic conductivity versus the cost of precursor materials of our work and the recent reports in premier journals.

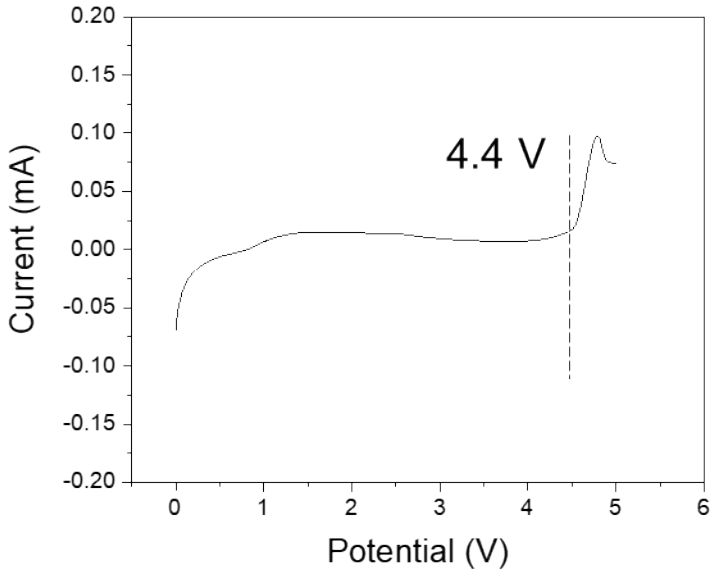


Fig. S9 The stable voltage window of RH_{SiO2} CPE.

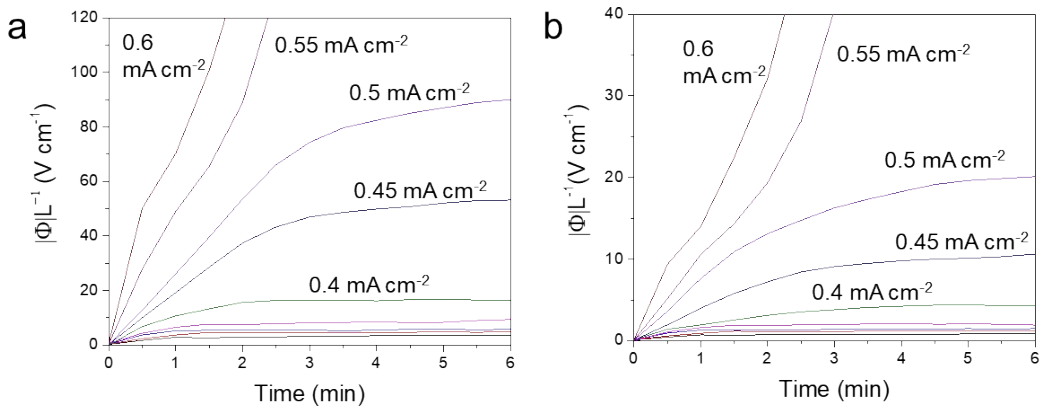


Fig. S10 The absolute value of the length-normalized potential of the (a) SPE and (b) RH_{SiO2} CPE electrolyte for various applied current densities.

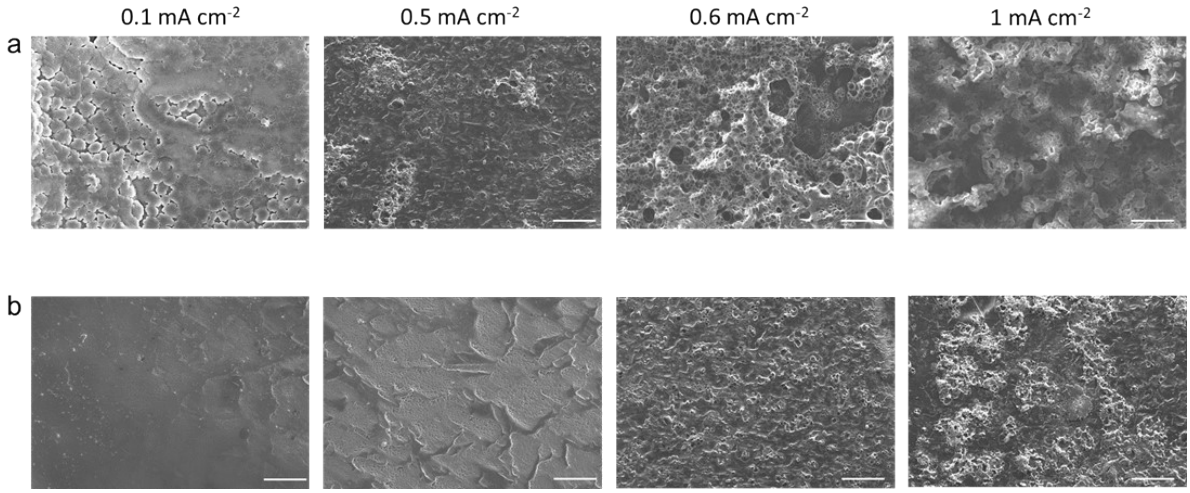


Fig. S11 The SEM images of dendrite formation with (a) SPE and (b) RH_{SiO2} CPE at various current densities. Scale bar: 20 μm.

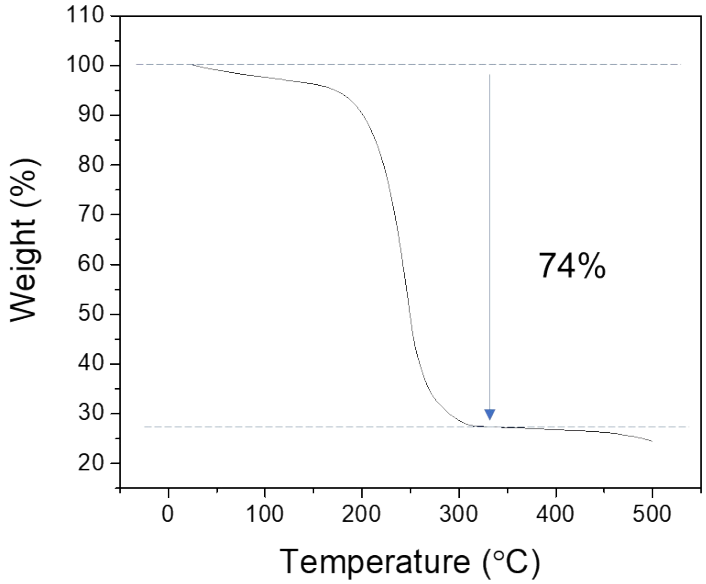
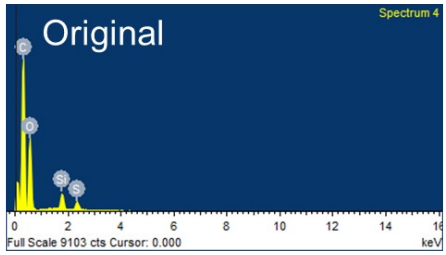


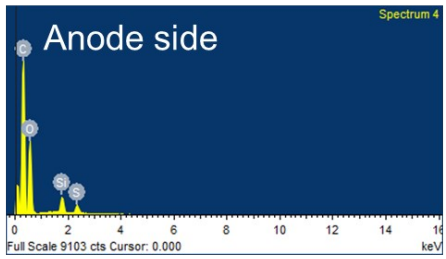
Fig. S12 The thermogravimetric analysis (TGA) of CMK-3/S material.

a



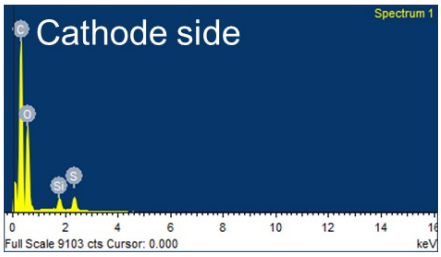
Element	Weight%	Atomic%
C K	54.90	62.52
O K	42.32	36.18
Si K	1.70	0.83
S K	1.08	0.46
Totals	100.00	

b



Element	Weight%	Atomic%
C K	55.19	62.78
O K	42.13	35.98
Si K	1.65	0.81
S K	1.03	0.44
Totals	100.00	

c



Element	Weight%	Atomic%
C K	54.27	61.92
O K	43.03	36.85
Si K	1.14	0.55
S K	1.57	0.67
Totals	100.00	

Fig. S13 The EDX analysis of the (a) original RH_{SiO2} CPE, the (b) top side, and (c) bottom side of RH_{SiO2} CPE after cycling.

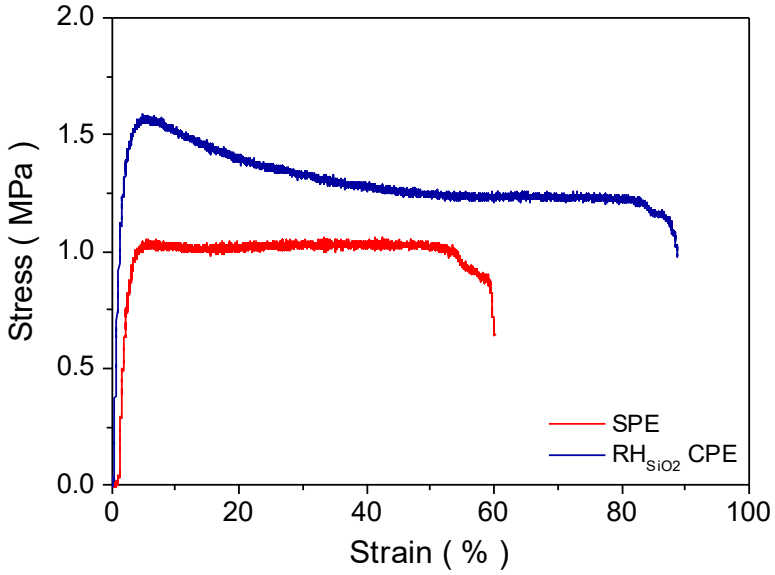


Fig. S14 The stress-strain curves of RH_{SiO2} CPE and the filler-free SPE.