Supporting Information

Effect of the $Ti_3C_2T_x$-PEDOT: PSS Modified-Separators on the electrochemical performance of Li-S batteries

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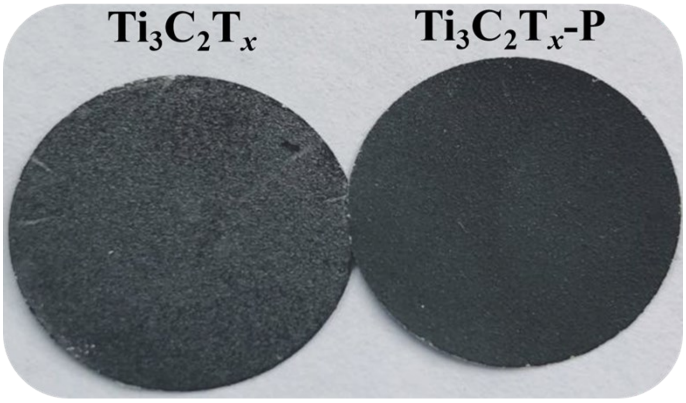

Fig. S1 Digital photographs of (a) pure $Ti_3C_2T_x$ and (b) $Ti_3C_2T_x$-P modified separators.

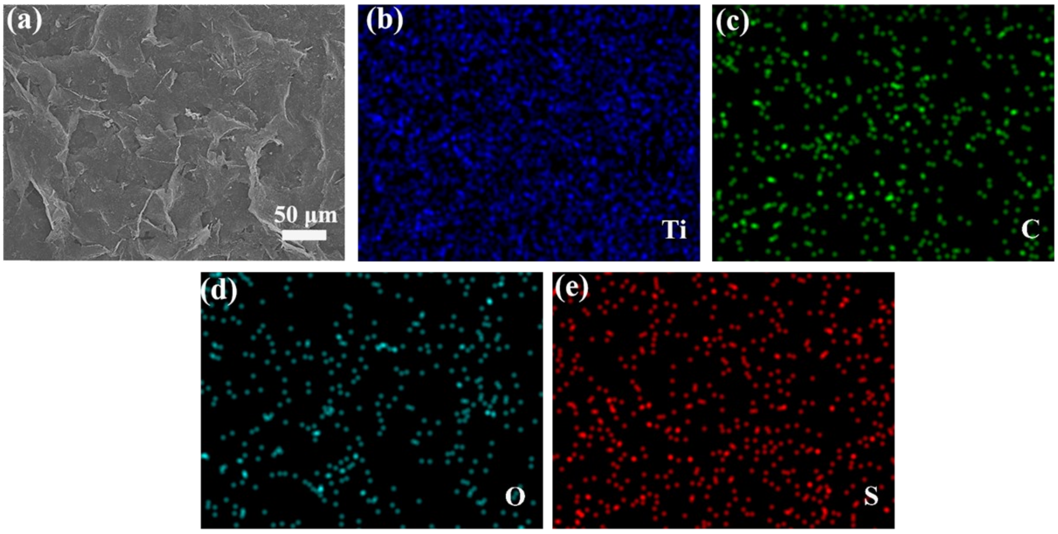

Fig. S2 (a) SEM image of the $Ti_3C_2T_x$-P hybrid. (b-e) Elemental mapping images of Ti/C/O/S element for the $Ti_3C_2T_x$-P hybrid.

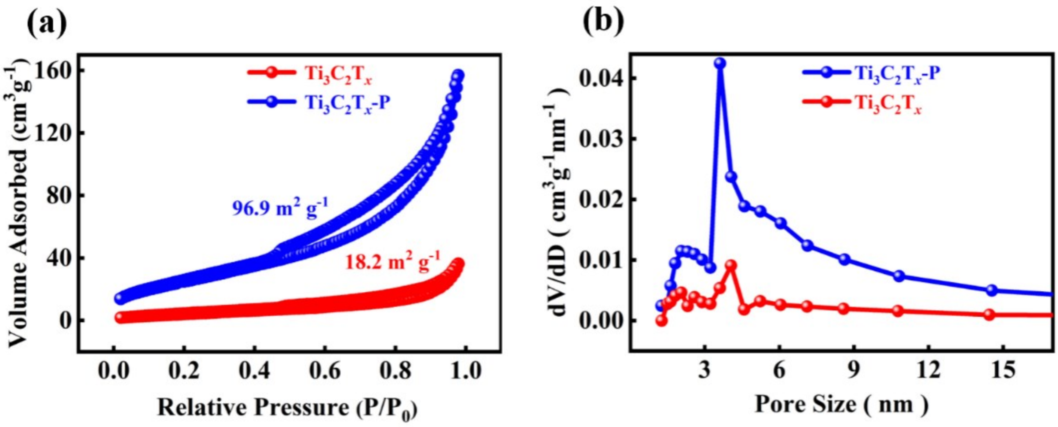

Fig. S3 (a) N_2 adsorption-desorption isotherms and (b) pore size distribution plot of the $Ti_3C_2T_x$ nanosheets and $Ti_3C_2T_x$-P hybrid, respectively.

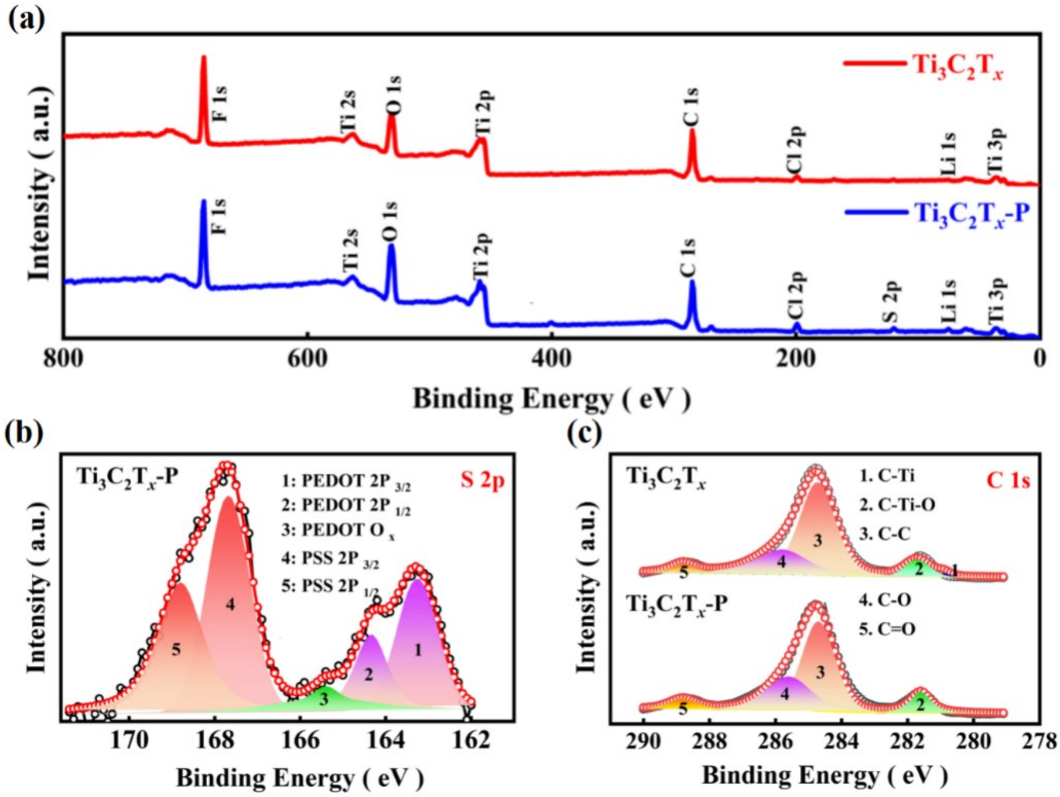

Fig. S4 (a) Survey XPS spectra. High-resolution (b) S 2p and (c) C 1s XPS spectra of $Ti_3C_2T_x$ nanosheets and $Ti_3C_2T_x$-P hybrid.

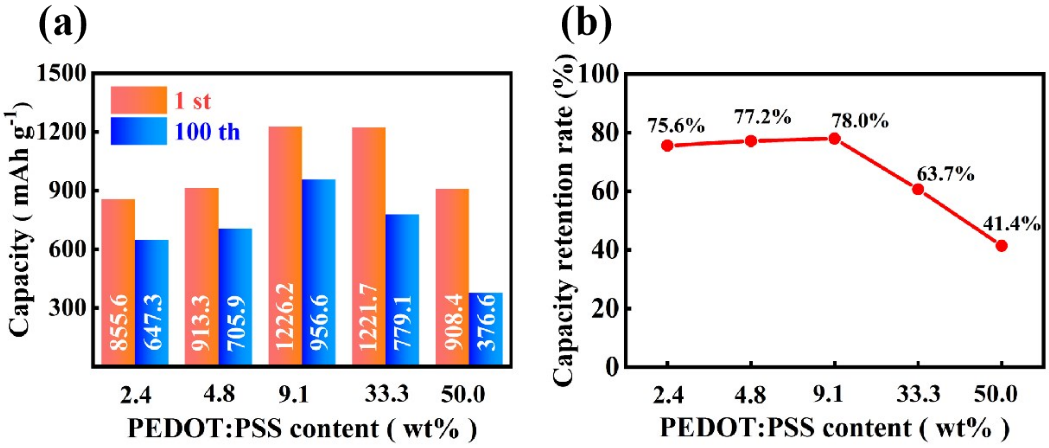

Fig. S5 (a) The cell capacity as a function of the PEDOT: PSS content for the first cycle (red) and the 100th (blue) at a current density of 0.5 C. (b) Capacity retention rate as a function of the PEDOT: PS content.

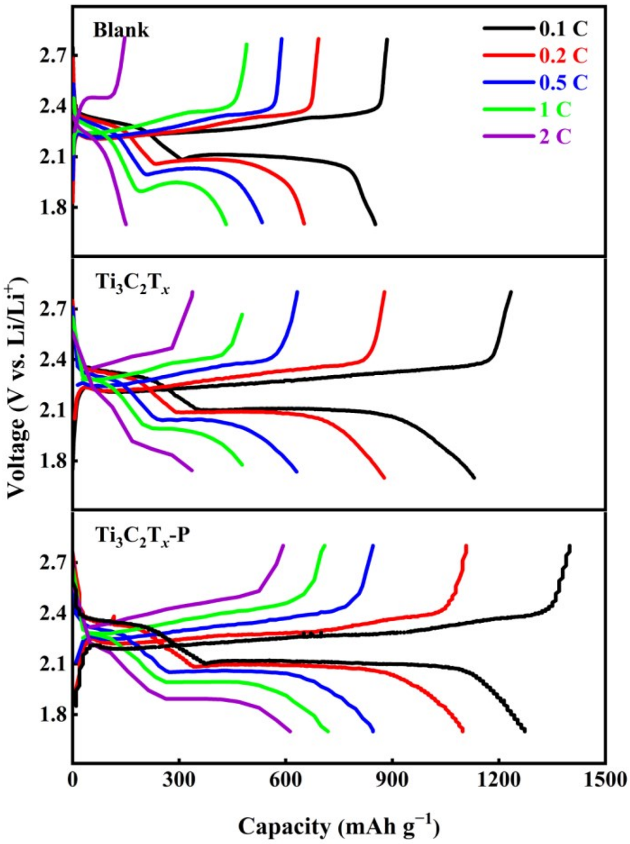

Fig. S6 GCD profiles of the cells with (a) blank, (b) $Ti_3C_2T_x$-modified and (c) $Ti_3C_2T_x$-P separators at different current densities.

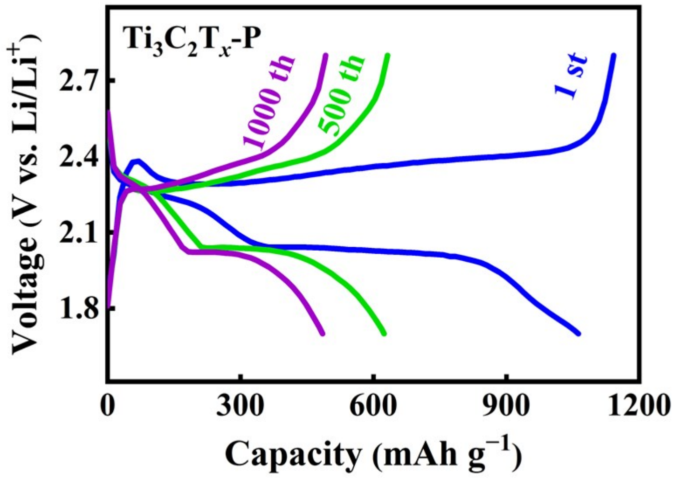

Fig. S7 GCD profiles of the cell with $Ti_3C_2T_x$-P separators at a current density of 0.5 C.

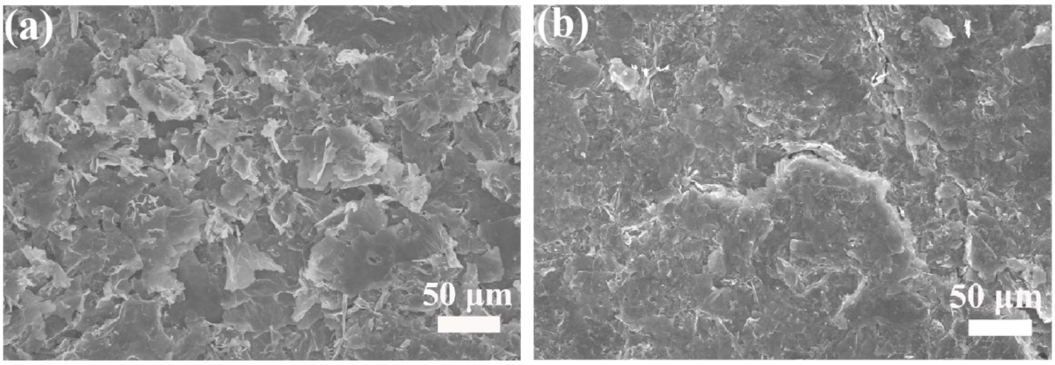

Fig. S8 SEM images of (a) pure $Ti_3C_2T_x$ and (b) $Ti_3C_2T_x$-P modified separators after 30 cycles at 0.5 C.

Table S1. XPS peak fitting results for $Ti_3C_2T_x$ nanosheets and $Ti_3C_2T_x$-P hybrid.

Sample1: $Ti_3C_2T_x$

Region	BE (eV)	Assigned to	Substance	Reference
Ti $2p_{3/2}$ ($2p_{1/2}$)	454.9(461.1)	Ti-C	$Ti_3C_2T_x$	[1]
	456.4(463.2)	Ti^{2+}	TiO_x (1.5<x<2)	[2]
	458.9(464.8)	Ti-O	TiO_2	[2,3]
O 1s	530.0	TiO_2	TiO_2	[2]
	531.9	C-Ti-O	$Ti_3C_2O_x$	[4,5]
	533.0	Al_2O_3		[4,5]
C 1s	280.9	C-Ti	$Ti_3C_2T_x$	[1]
	281.7	C-Ti-O	C	[2,6]
	284.7	C-C	C	[2,6]
	285.8	C-O	C	[2,6]
	288.8	C=O	C	[2,6]

Sample2: $Ti_3C_2T_x$-P

Region	BE (eV)	Assigned to	Substance	Reference
Ti $2p_{3/2}$ ($2p_{1/2}$)	455.3(461.2)	Ti-C	$Ti_3C_2T_x$	[1,5]
	456.4(463.2)	Ti^{2+}	TiO_x	[2]
	459.3(464.8)	Ti-O	(1.5<x<2)	[3,4]
			TiO_2	
O 1s	529.8	TiO_2	TiO_2	[2]
	531.7	C-Ti-O/PSS	$Ti_3C_2T_x$-P	[3]
	533.2	PEDOT	PEDOT	[4,7]
C 1s	281.6	C-Ti-O	C	[2,6]
	284.7	C-C	C	[2,6]
	285.6	C-O	C	[2,6]
	288.8	C=O	C	[2,6]
S 2p	163.3	PEDOT$2p_{3/2}$	PEDOT: PSS	[5,7]
	164.4	PEDOT$2p_{1/2}$	PEDOT: PSS	[5,7]
	165.4	PEDOT Oxidized (O_x)	PEDOT: PSS	[5,7]
	167.7	PSS$2p_{3/2}$	PEDOT: PSS	[5,7]
	168.8	PSS$2p_{1/2}$	PEDOT: PSS	[5,7]

Table S2. Electrical conductivities of $Ti_3C_2T_x$ nanosheets and $Ti_3C_2T_x$-P hybrid.

Samples	**Conductivity, S/cm**
$Ti_3C_2T_x$	1.66
$Ti_3C_2T_x$-P	3.19

References

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