Supplementary Information

Core-shell structured Mn_2SnO_4@Void@C as stable anode material for lithium-ion batteries with long cycle life

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Figure Captions:

Fig. S1 XRD pattern of $MnSn(OH)_6$
Fig. S2 SEM image of $MnSn(OH)_6$
Fig. S3 TEM images of $MnSn(OH)_6$@SiO_2
Fig. S4 TEM images of Mn_2SnO_4@SiO_2@C
Fig. S5 TEM images of Mn_2SnO_4@C
Fig. S6 High-resolution XPS spectra of C 1s peak for Mn_2SnO_4@C and Mn_2SnO_4@Void@C
Fig. S7 Galvanostatic discharge/charge curves of Mn_2SnO_4@C (a) and Mn_2SnO_4 (b) for selected cycles at 100 mA g^{-1}
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Fig. S9 Corresponding relationships between $\omega^{-1/2}$ and Z' at a low frequency of Mn_2SnO_4, Mn_2SnO_4@C and Mn_2SnO_4@Void@C
Fig. S10 SEM images of cross-sectional morphology for Mn_2SnO_4@Void@C electrode after 0 (a) and 1000 (b) discharge-charge cycles
Fig. S11 SEM images of surface morphology for Mn_2SnO_4, Mn_2SnO_4@C and Mn_2SnO_4@Void@C electrode after 0 (a, b and c, respectively) and 1000 (e, d and f, respectively) charge-discharge cycles at 1.0 A g^{-1}

Table Captions:

Table S1. Vibration types of absorption peaks on FTIR spectra
Table S2. Fitted EIS results of raw materials
Table S3. Electrochemical performance comparison of Mn_2SnO_4@Void@C and other Sn-based materials for lithium-ion half cell

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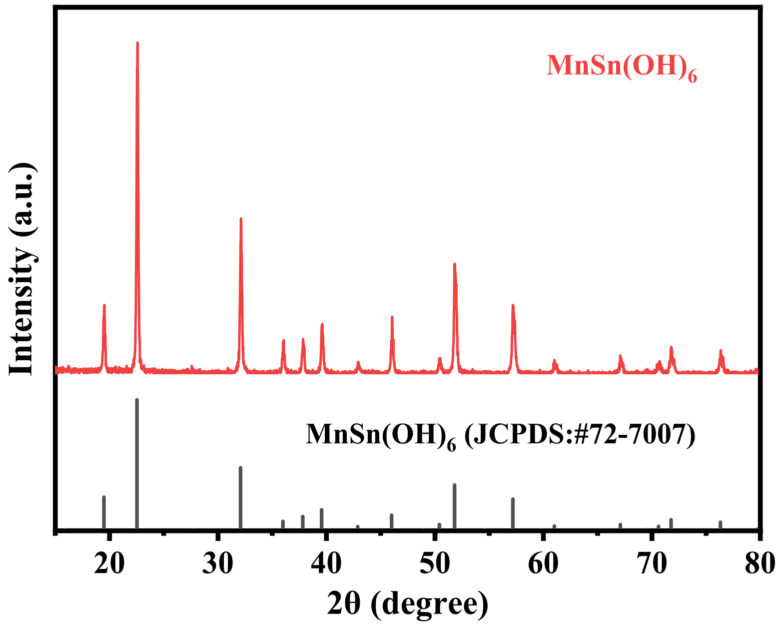

Fig. S1 XRD pattern of $MnSn(OH)_6$ precursor

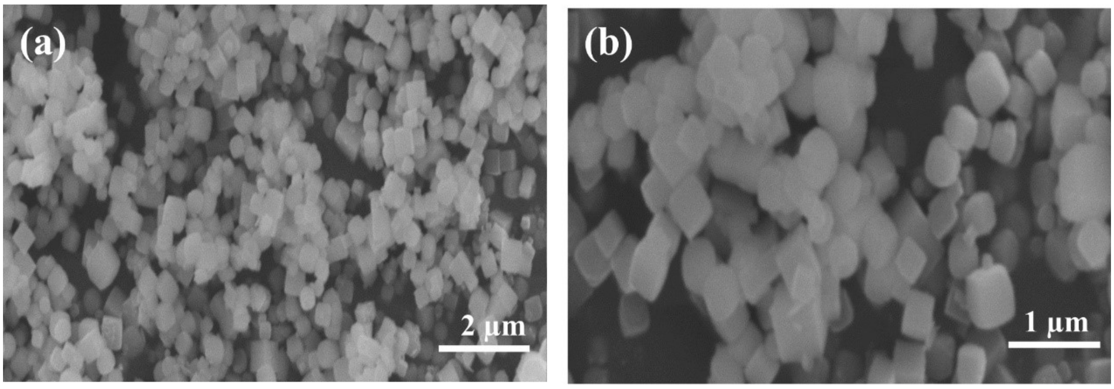

Fig.S2 SEM images of $MnSn(OH)_6$

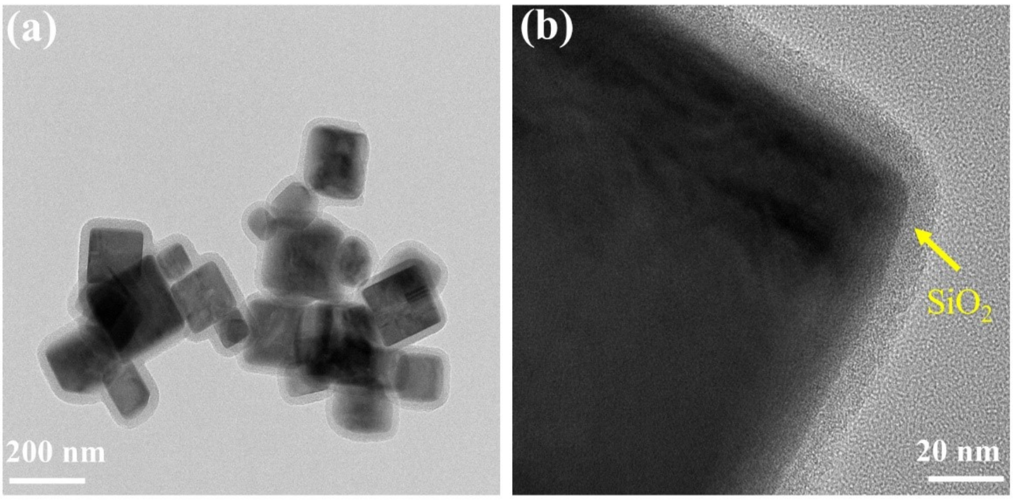

Fig.S3 TEM images of $MnSn(OH)_6@SiO_2$

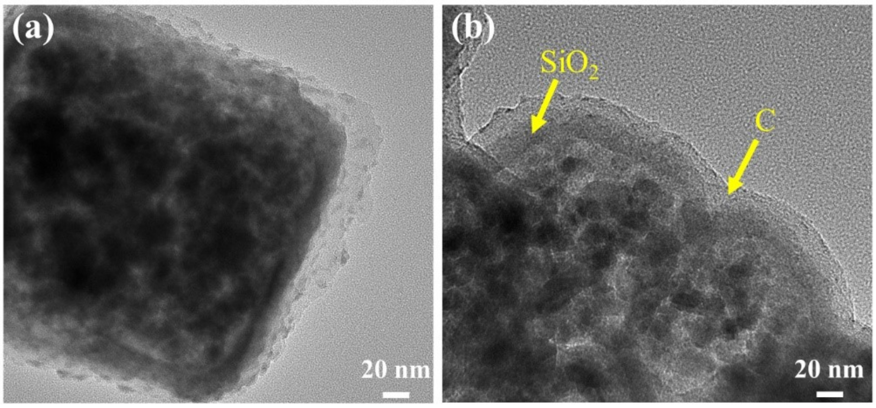

Fig. S4 TEM images of $Mn_2SnO_4@SiO_2@C$

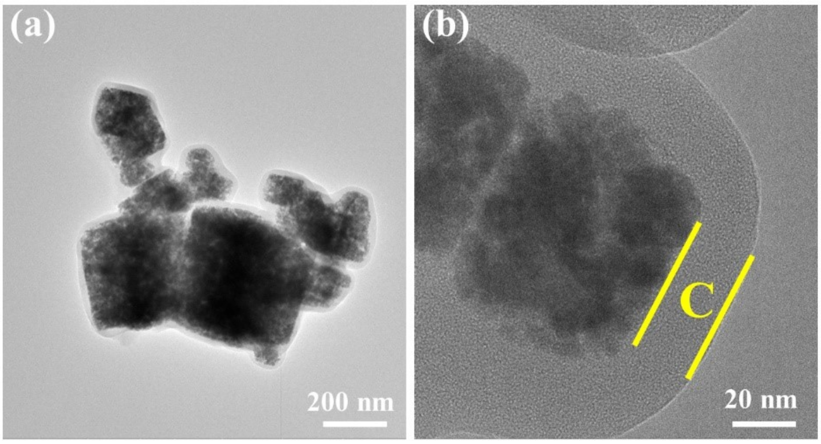

Fig. S5 TEM images of Mn_2SnO_4@C

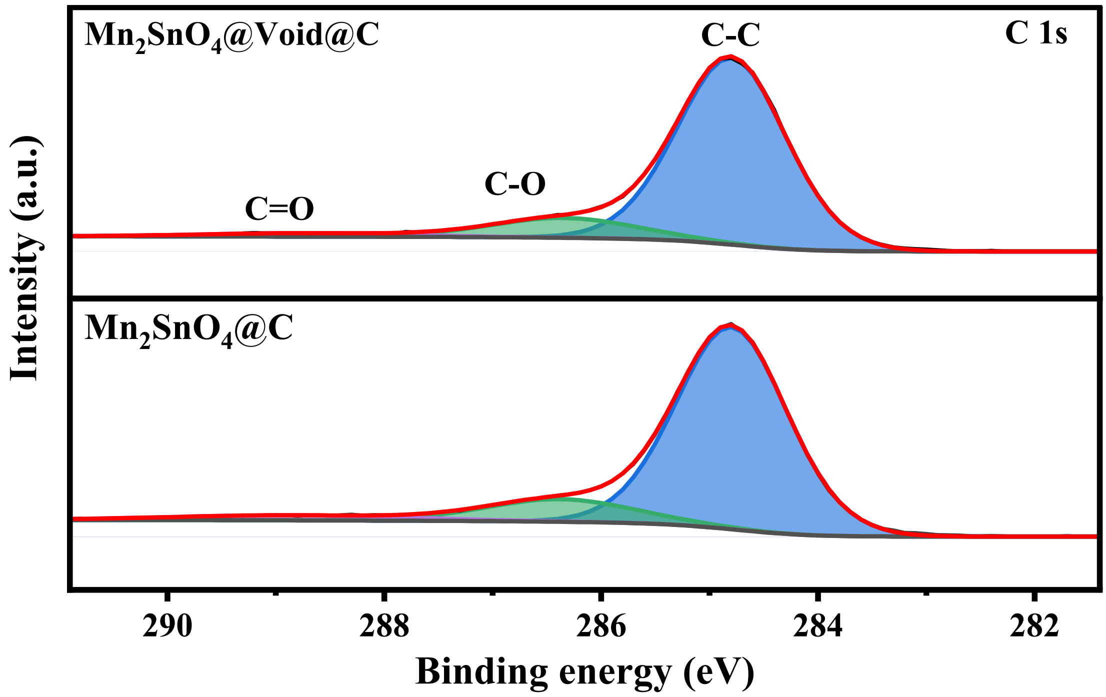

Fig. S6 High-resolution XPS spectra of C 1s peak for Mn_2SnO_4@C and Mn_2SnO_4@Void@C

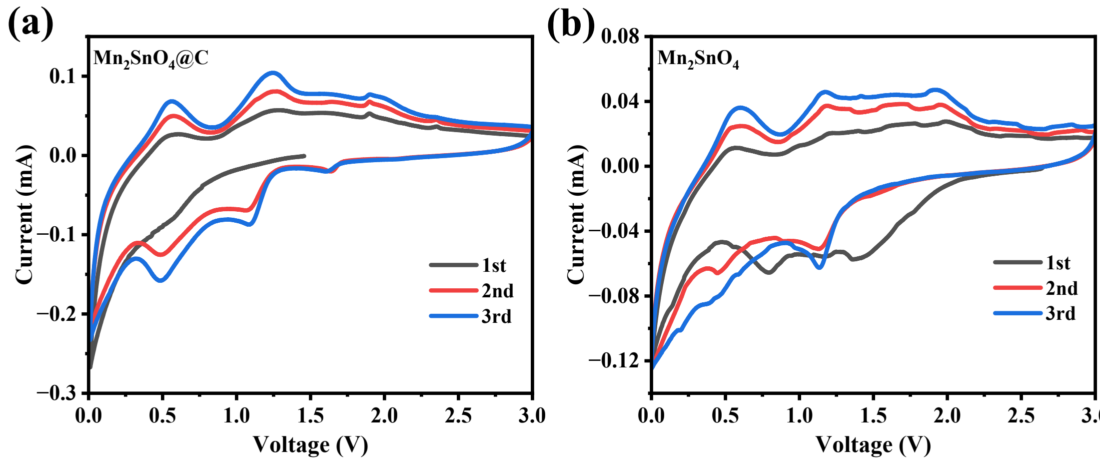

Fig. S7 Cyclic voltammetry (CV) curves of Mn_2SnO_4@C (a) and Mn_2SnO_4 (b) at a scan rate of 0.1 mV s^{-1}

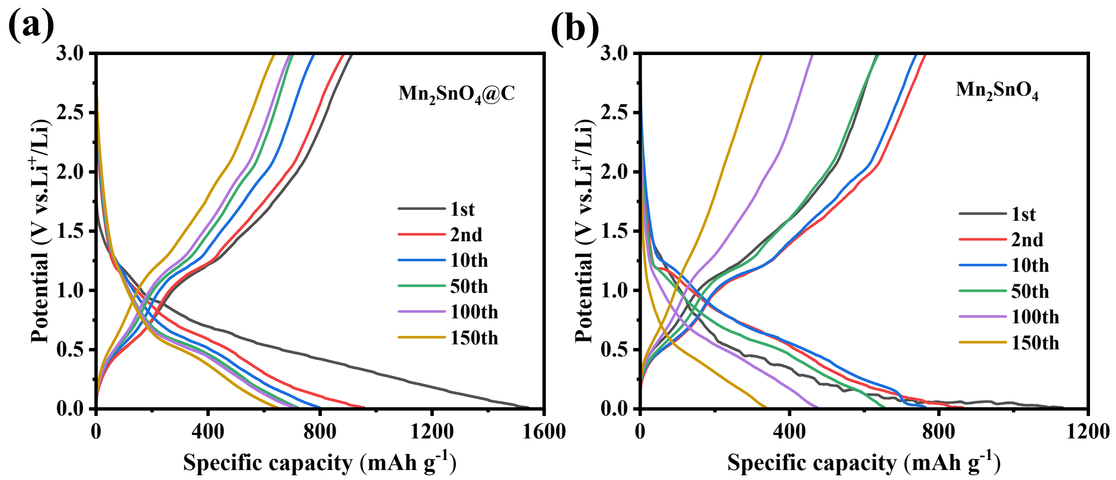

Fig. S8 Galvanostatic discharge/charge curves of Mn_2SnO_4@C (a) and Mn_2SnO_4 (b) for selected cycles at 100 mA g^{-1}

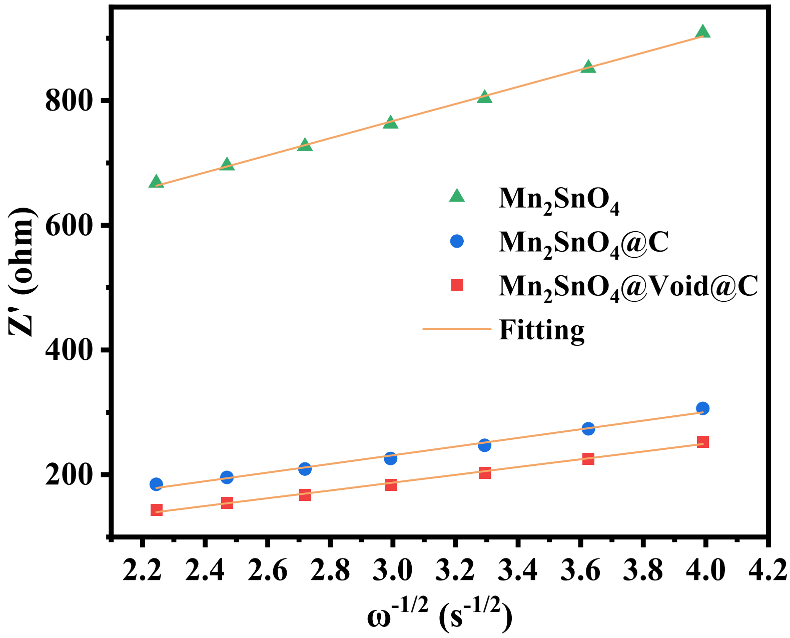

Fig. S9 Corresponding relationships between $\omega^{-1/2}$ and Z' at low frequency of Mn_2SnO_4, Mn_2SnO@C and Mn_2SnO_{44}@Void@C

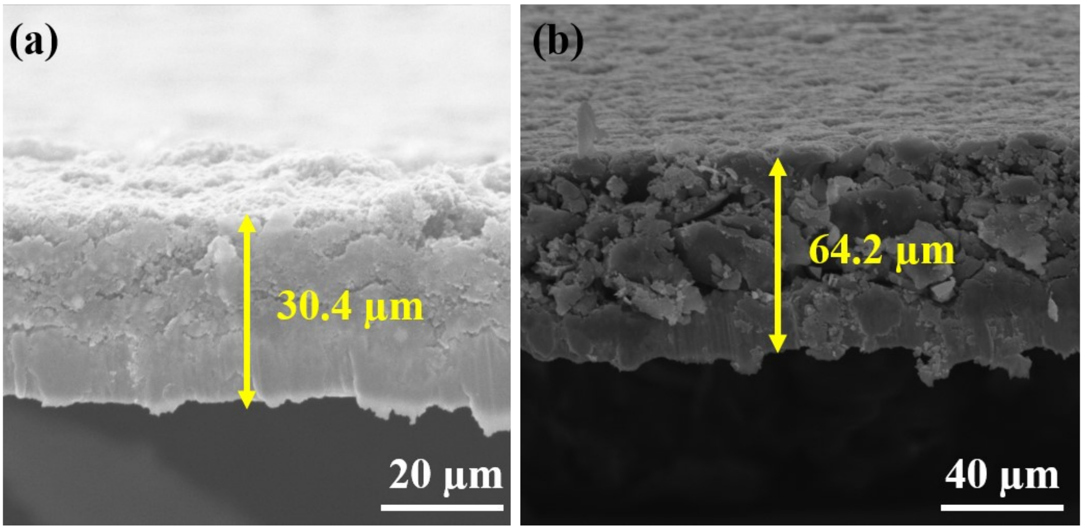

Fig. S10 SEM images of cross-sectional morphology for Mn_2SnO_4@Void@C electrode after 0 (a) and 1000 (b) discharge-charge cycles

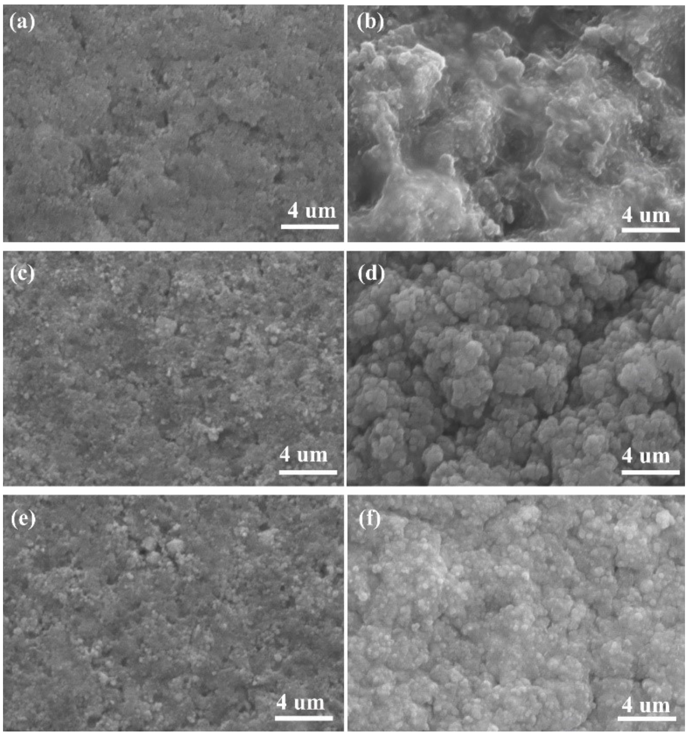

Fig. S11. SEM images of surface morphology for Mn_2SnO_4, Mn_2SnO_4@C and Mn_2SnO_4@Void@C electrode after 0 (a, b and c, respectively) and 1000 (e, d and f, respectively) charge-discharge cycles at 1000 mA g^{-1}

Table S1 Vibration types of absorption peaks on FTIR spectra

Wavenumber（cm^{-1}）	Chemical bond	Vibration type
499	Mn-O-Mn	bending vibration
541	Sn-O-Sn	bending vibration
887	C-H	bending vibration
1257	C-O	stretching vibration
1598	C=C	stretching vibration
3372	-OH	stretching vibration

Table S2 Fitted EIS results of as-prepared materials

Sample	Rs (Ω)	Rct (Ω)	CPEct-T (μF)	CPEct-P (μF)
Mn_2SnO_4	6.021	353.3	1.6325E-5	0.79427
Mn_2SnO_4@C	3.265	90.69	1.0669E-5	0.86296
Mn_2SnO_4@Void@C	4.04	51.35	1.4388E-5	0.82645

Table S3 Electrochemical performance comparison of Mn_2SnO_4@Void@C and other Sn-based materials for lithium-ion half cell

Materials	Current density ($A\ g^{-1}$)	Cycles	Reversible capacity ($mAh\ g^{-1}$)	References
Sn@Mn_2SnO_4-NC	0.1	100	1039.5	1
Mn_2SnO_4@Carbon Nanotube	0.1	100	611	2
Mn_2SnO_4/Sn/C Cubes	0.5	100	908	3
Mn_2SnO_4@RGO	0.1	100	542	4
Flake-like Mn_2SnO_4/C	2.0	100	428	5
SnO_2/Mn_2SnO_4@C	0.2	100	1293	6
Bouquet-Like Mn_2SnO_4@GS	0.4	200	1070	7
	0.1	150	783.1	
Mn_2SnO_4@Void@C	1.0	1000	553.3	This work
	2.0	400	419.6	

Supplementary Information References:

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