Electronic Supporting Information (ESI)

Ultra-high ICE and long cycle stability sodium-ion battery anode: Hybrid nanostructure of dominant pyridine N-doped sisal fiber derived carbon-MoS_2

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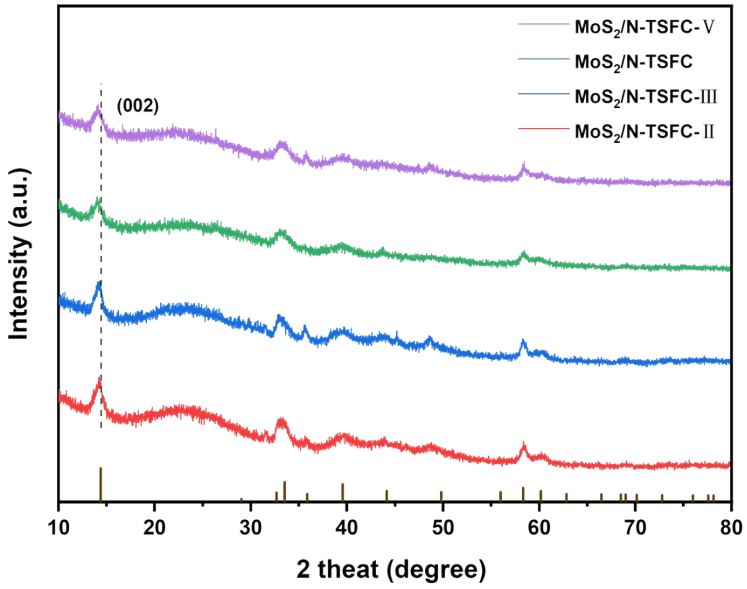

Fig.S1 XRD patterns of MoS_2/N-TSFC composites prepared at different conditions, and MoS_2 standard samples.

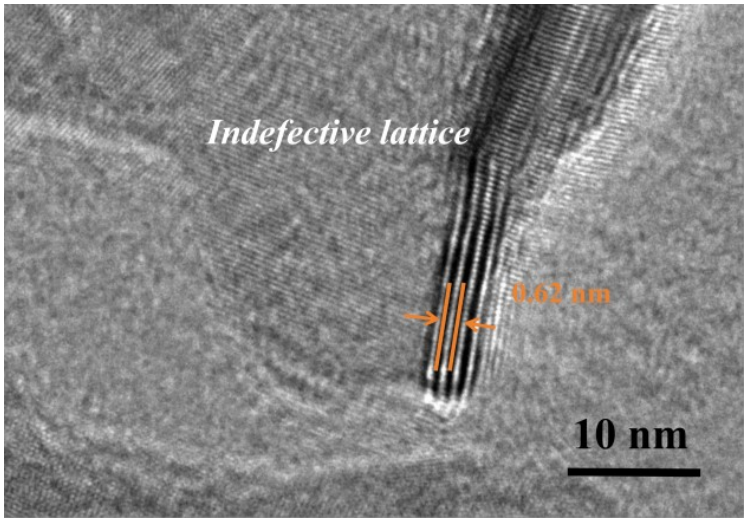

Fig. S2 The HRTEM image of MoS_2/TSFC.

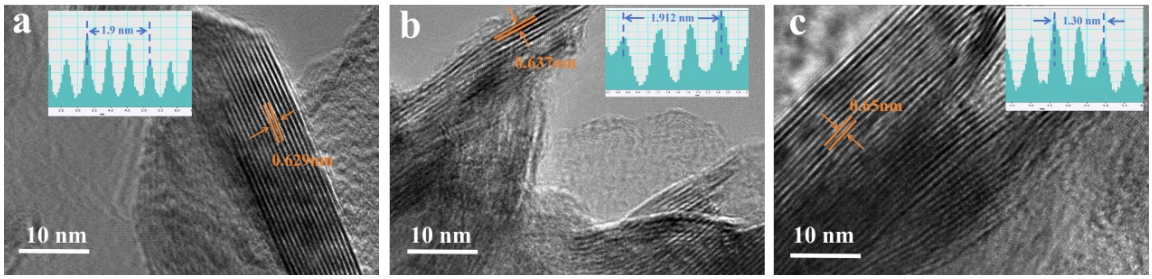

Fig. S3 The HRTEM images of (a) MoS_2/N-TSFC-II, (b) MoS_2/N-TSFC-III and (c) MoS_2/N-TSFC-V.

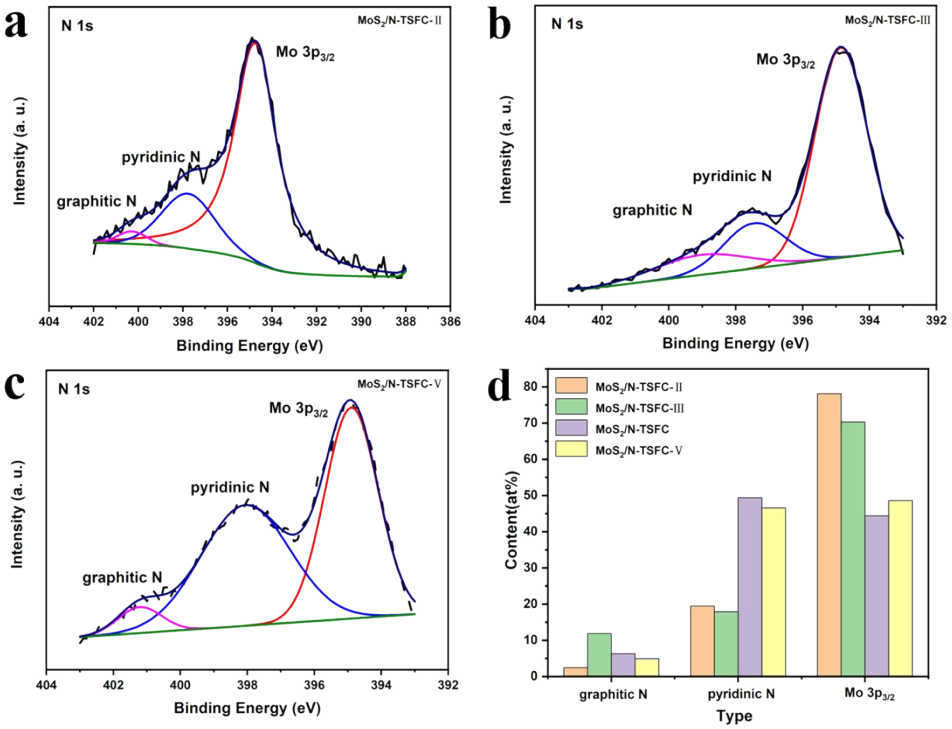

Fig.S4 XPS N1s spectra of (a) MoS_2/N-TSFC-II, (b)MoS_2/N-TSFC-III, (c) MoS_2/N-TSFC-V, (d) different N configurations of samples.

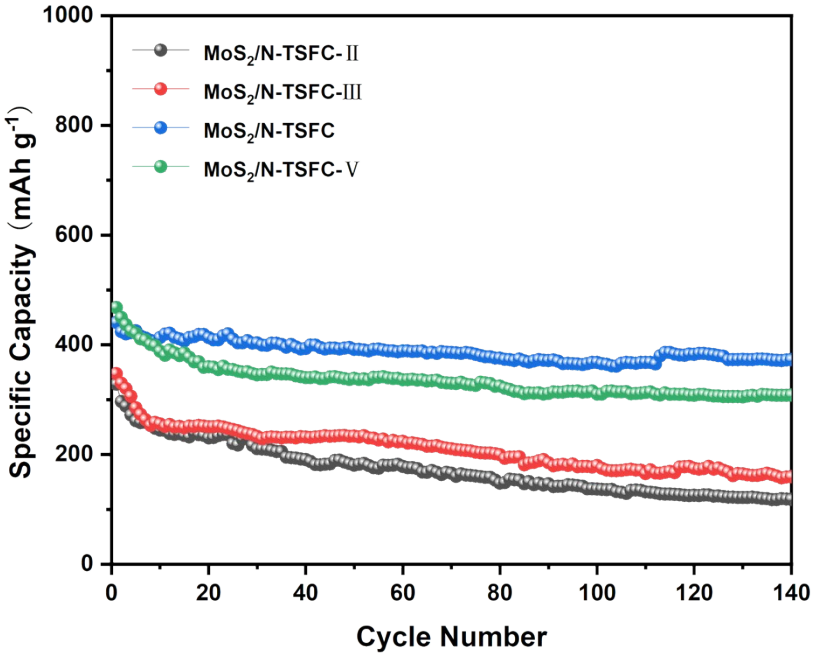

Fig. S5 Cycling performance of different MoS_2/N-TSFC composites at 0.1 A g^{-1}.

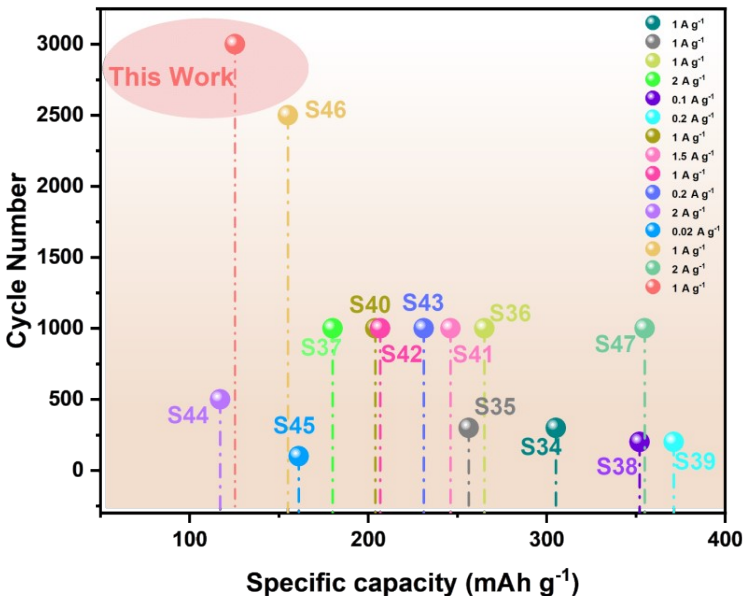

Fig. S6 Comparisons of the electrochemical performance of MoS_2/N-TSFC with other reported MoS_2-based anodes for SIBs.

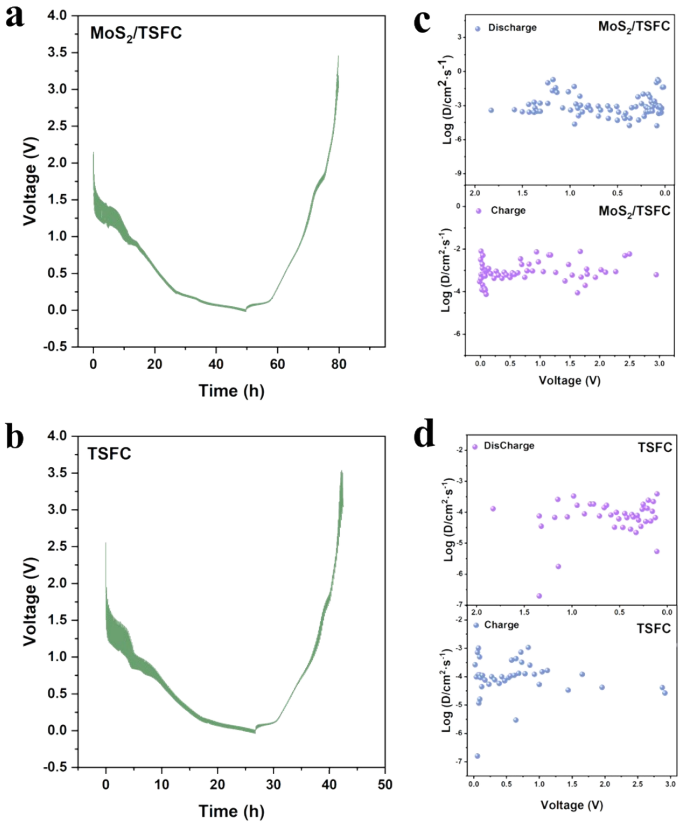

Fig. S7 (a-b) GITT plots, (c-d) D_{Na}^+ values of MoS_2/TSFC, and TSFC.

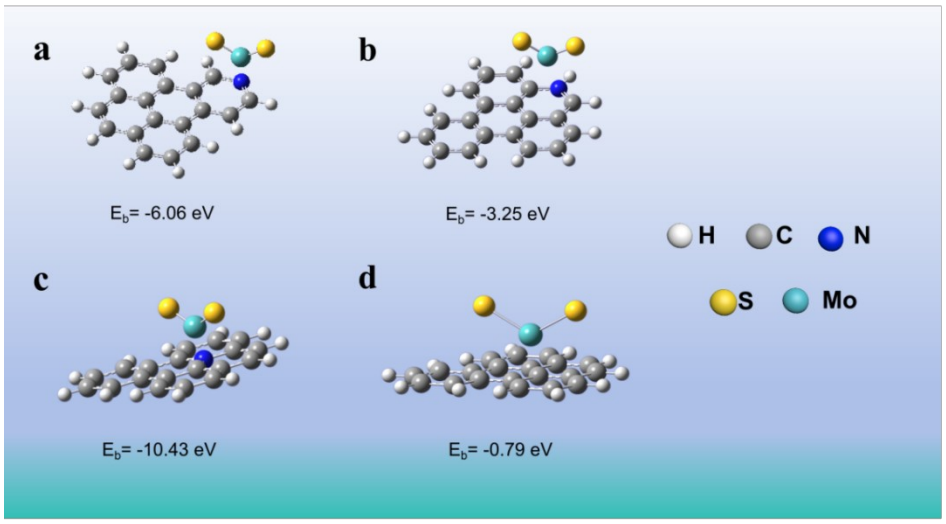

Fig. S8 Atomic models of MoS_2/TSFC with different N species and binding energies (E_b) resulted from DFT calculations, (a) pyridine N+MoS_2/TSFC compound, (b) pyrrole N+MoS_2/TSFC compound, (c) graphite N+MoS_2/TSFC compound, and (d) MoS_2/TSFC compound.

Table S1 The XRD $d_{(002)}$ layer spacing parameters for samples.

Samples	$MoSe_2$/N-TSFC-II	$MoSe_2$/N-TSFC-III	$MoSe_2$/N-TSFC	$MoSe_2$/N-TSFC-V
$d_{(002)}$ (Å)	6.33	6.37	6.58	6.50

Table S2 The atomic content of different N species calculated from N 1s.

Samples	graphite-N (at%)	pyridine-N (at%)	Mo $3p_{3/2}$ (at%)
MoS_2/N-TSFC-II	2.42	19.48	78.11
MoS_2/N-TSFC-III	11.87	17.85	70.28
MoS_2/N-TSFC	6.29	49.34	44.37
MoS_2/N-TSFC-V	7.88	46.51	43.61

Table S3 Comparisons of pyridinic N content (at%) with previously reported work.

Samples	Pyridinic N (%)	ICE (%)	Reference
carbon@750 ℃	33.08	74	[1]
NPUCS	49	75	[2]
PNHC	40.3	56.9	[3]
p-CNTs@HC-1000	41.4	98	[4]
N-MDC	44.54	52	[5]
HNCs	65	61	[6]
NMC2	28.87	-	[7]
Co-Ni-S@NSC	48.9	76.8	[8]
NPC-900	28.6	74.9	[9]
CS-1000	65.4	-	[10]
MoS_2/N-TSFC	**49.34**	**93**	**This work**

Table S4 Some performance parameters of recently reported materials in SIBs.

Samples	Surface area (m^2 g^{-1})	ICE (%)	Reference
HCC	3.733	86	[11]
CNF	24	73	[12]
Wood fiber derived hard carbon	126	72	[13]
Sucrose derived hard carbon	5.4	83	[14]
P-doped sucrose derived hard carbon	7	73	[15]
Chitosan derived hard carbon	47.6	85.9	[16]
SHCs-1500	1.6	90.5	[17]
PHC-0.2	44.31	92.2	[18]

Table S5 Comparisons of the electrochemical performance of MoS_2/N-TSFC with reported HC-based composite material anodes.

Material	Initial reversible capacity	ICE	Reference
NPC-CNT@G	315 mAh g^{-1} at 0.05 A g^{-1}	43%	[19]
HCN-800	450 mAh g^{-1}at 0.1 A g^{-1}	45%	[20]
NSC2	280 mAh g^{-1} at 0.05 A g^{-1}	35.9%	[21]
HC@CNF	360 mAh g−1 at 0.025 A g^{-1}	60%	[22]
0.04 M-MnHC	336.8 mAh g^{-1} at 0.02 A g^{-1}	92.05%	[23]
N-CNS-1050	304.7 mAh g^{-1} at 0.05 A g^{-1}	79.52%	[24]
e-HC	335.6 mAh g^{-1} at 0.03 A g^{-1}	77%	[25]
Co_2P@N-C@rGO	336 mAh g^{-1} at 0.05 A g^{-1}	24.9%	[26]
HCSs-CNTs	214.7 mAh g^{-1} at 0.03 A g^{-1}	33.1%	[27]
Ni_3Se_4@$CoSe_2$@C/CNTs	333 mAh g^{-1} at 0.1 A g^{-1}	54.5%	[28]
N/S-HC	290 mAh g^{-1} at 0.03 A g^{-1}	66%	[29]
F-MoS_2@NCN-0.8	407.6 mAh g^{-1} at 0.05 A g^{-1}	70%	[30]
MoS_2@NSC	441 mAh g^{-1} at 0.1 A g^{-1}	74.4%	[31]
MoO_3/MoS_2/NC/MXene	434 mAh g^{-1} at 0.1 A g^{-1}	59.6%	[32]
MoS_2/NC	435.97 mAh g^{-1} at 0.2 A g^{-1}	74.75%	[33]
MoS_2/N-TSFC	**589.4mAh g^{-1} at 0.02A g^{-1}**	**93.0%**	**This work**

Table S6 Comparisons of the electrochemical performance of MoS_2/N-TSFC with other reported MoS_2-based anodes for SIBs.

Samples	Current density(A g^{-1})	Reversible capacity(mAh g^{-1})	Cycles	Reference
MoS_2@AMCRs	1	305	300	[34]
F-MoS_2@NCN	1	256.3	300	[35]
CC@CN@MoS_2	1	265	1000	[36]
HC@MoS_2@NC	2	180	1000	[37]
MoS_2@N-C	0.1	352	200	[38]
S-BC/E-MoS_2@NC	0.2	371.1	200	[39]

N-HCS	1	204	1000	[40]
N-C@MoS_2	1.5	246	1000	[41]
OPBNP	1	206.6	1000	[42]
PLHC-N-1000	0.2	231	1000	[43]
MoS_2/FAC	2	117	500	[44]
MoS_2 nanosheets	0.02	161	100	[45]
NS-MPC	2	155	2500	[46]
MoS_2@MXene	1	354.8	1000	[47]
MoS_2/N-TSFC	**1**	**125.3**	**3000**	**This work**

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