Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting Information

Layered Bi_2Te_3 Nanoplates/Graphene Composites with High Gravimetric and Volumetric Performance for Na-Ion Storage

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Supporting Data:

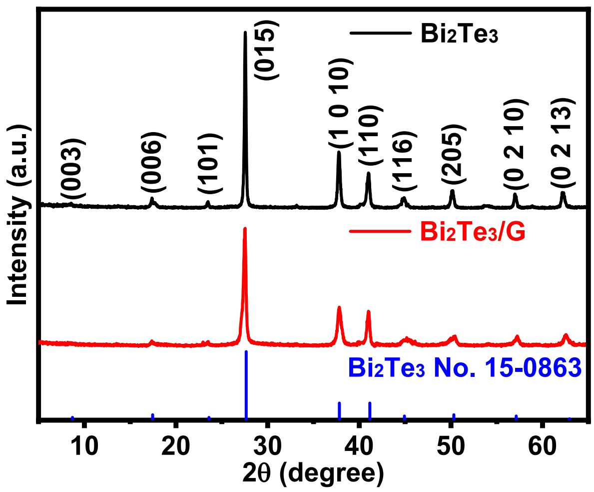

Fig. S1 XRD patterns of pure Bi_2Te_3 and Bi_2Te_3/G composite.

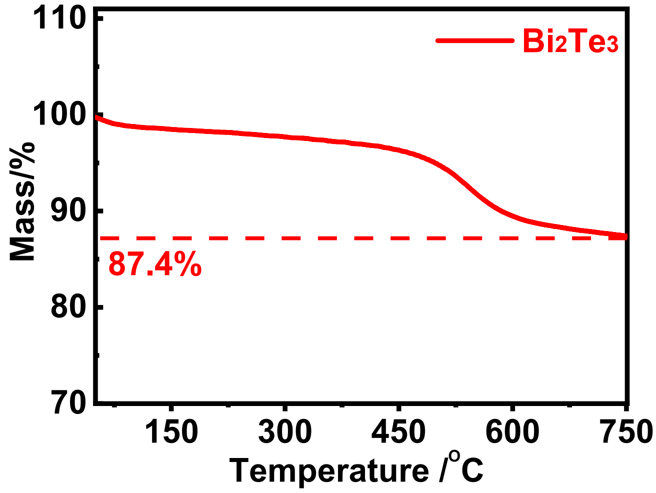

Fig. S2 TG curve of Bi_2Te_3/G composite obtained in air atmosphere from room temperature to 800 ^{o}C at a rate of 10 ^{o}C min^{-1}.

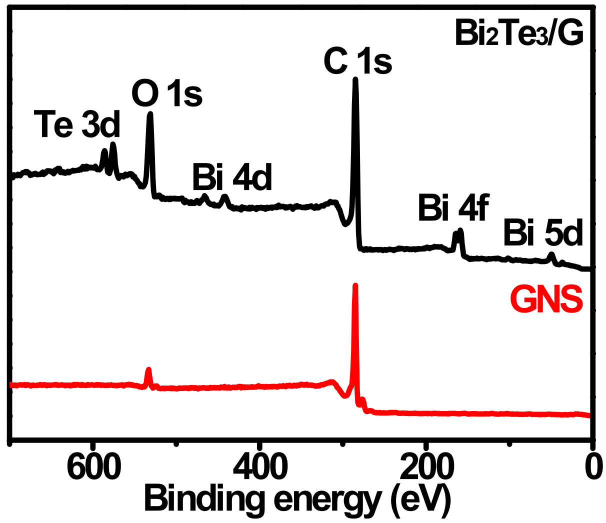

Fig. S3 XPS survey spectra of the Bi_2Te_3/G composite and GNS.

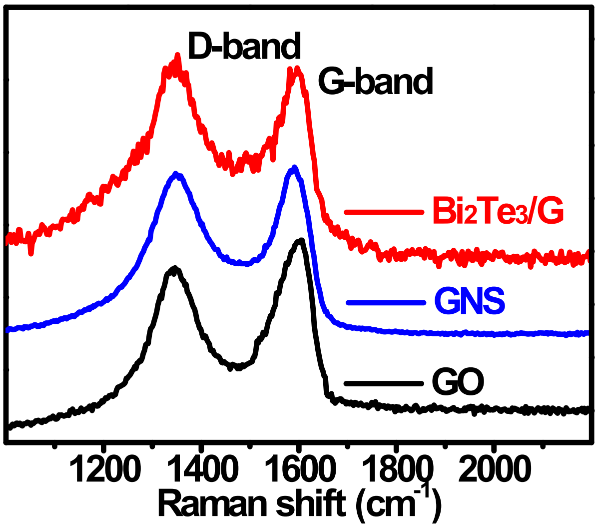

Fig. S4 Raman spectra of GO, GNS, and Bi_2Te_3/G composite.

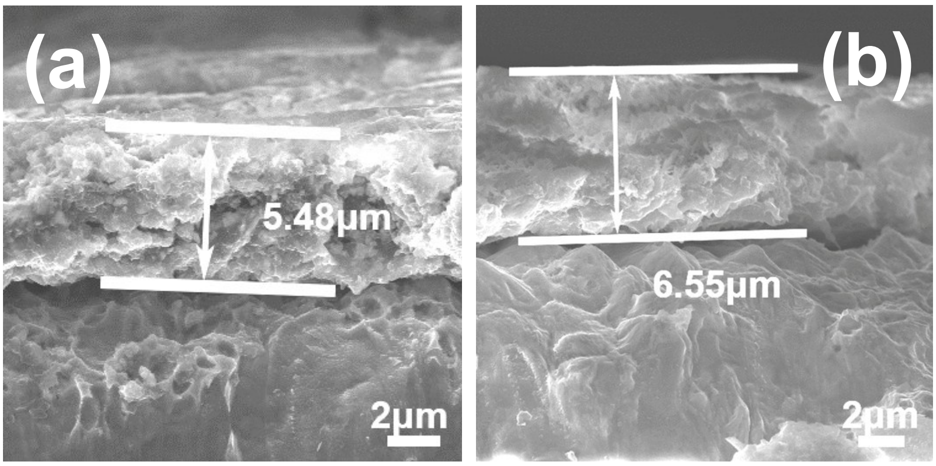

Fig. S5 Cross-section SEM images of (a) fresh Bi_2Te_3/G electrode with mass loading of 1.31 mg and (b) the Bi_2Te_3/G electrode after 50 cycles at 1 A g^{-1} with mass loading: 1.43 mg.

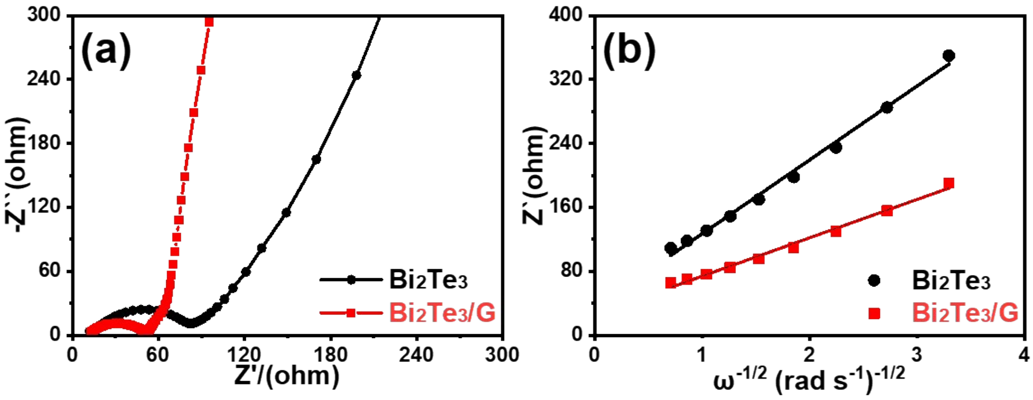

Fig. S6 (a) EIS curves of pure Bi_2Te_3 and Bi_2Te_3/G composite obtained after two cycles at 1 A g^{-1}; and (b) the relationship plots between Z' and $\omega^{-1/2}$ at low-frequency region of pure Bi_2Te_3 and Bi_2Te_3/G composite.

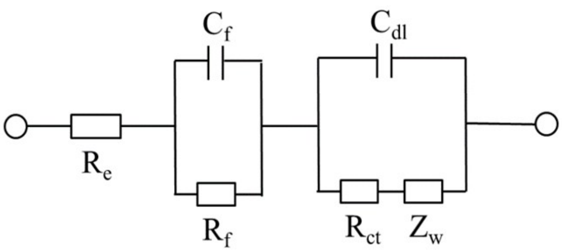

Fig. S7 Equivalent circuit used for fitting of EIS curves (Fig. S5), where R_e is the electrolyte resistance; C_f and R_f are the capacitance and resistance of the surface SEI film formed on the electrodes, respectively; C_{dl} and R_{ct} are the double-layer capacitance and charge-transfer resistance, respectively; Z_w is the Warburg impedance related to the diffusion of Na-ions into the bulk electrodes.

Table S1 Layered chalcogenide and their corresponding interlayer spacing.

Materials	Interlayer Spacing (Å)	Materials	Interlayer Spacing (Å)	Materials	Interlayer Spacing (Å)
Bi_2Se_3	9.56	$PdTe_2$	5.13	TiS_2	5.70
Bi_2Te_3	**10.16**	PtS_2	5.02	$TiSe_2$	5.99
$CoTe_2$	5.40	$PtSe_2$	5.06	$TiTe_2$	6.51
$GaTe_3$	5.90	$PtTe_2$	5.20	VS_2	5.73
HfS_2	5.84	ReS_2	6.08	WS_2	6.18
$HfSe_2$	6.16	$RhTe_2$	5.41	WSe_2	6.49
$IrTe_2$	5.39	Si_2Te_3	6.74	WTe_2	7.02
MoS_2	6.20	$SiTe_2$	6.71	ZrS_2	5.81
$MoSe_2$	6.50	SnS_2	5.87	$ZrSe_2$	6.14
$MoTe_2$	7.00	$SnSe_2$	6.14	$ZrSe_3$	9.36
NbS_2	5.96	SnSSe	6.05	$ZrTe_2$	6.63
$NiTe_2$	5.30	TaS_2	5.86	$ZrTe_3$	10.01

Table S2 Electrochemical performance comparison of some advanced metal telluride anode materials for SIBs.

Materials	Voltage range (V)	Initial Coulombic efficiency (%)	Initial discharge/charge Capacity (mAh/g)	Rate performance Gravimetric capacity (mAh/g)	Volumetric capacity (mAh/cm^3)	Current rate (A/g)	Cycle life	Ref.
$FeTe_2$-rGO	0.001-3.0	76	493/373	421	---	0.1	80	1
				384	---	0.5		
				362	---	1		
				321	---	2		
				257	---	3		
C@$MoTe_2$	0.001-3.0	71.9	388/279	343	---	0.2	200	2
				306	---	0.5		
				280	---	1		
				254	---	2		
				236	---	3		
				209	---	5		
SnTe/C	0.001-2.5	62.7	541/339	316	639	0.03	100	3
				292	600	0.06		
				272	540	0.16		
				243	490	0.32		
				225	455	0.64		
				213	430	0.96		
C@$Cu_{1.75}Te$	0.005-3.0	37.3	843/314	245.2	---	0.2	500	4
				127.8	---	0.5		
				68.1	---	1		
				44.4	---	3		
$NiTe_2$@NCNs	0.3-2.8	94.1	284.5/267.7	289.5	---	0.1	5000	5
				281.5	---	1		
				275.7	---	2		
				271.6	---	5		
Bi_2Te_3	0.3-2.8	79.3	464/368	247.3	910.0	0.1	50	This work
				183.5	675.2	0.2		
				98.4	362.1	0.5		
				50.4	185.4	1.0		
				26.4	97.1	2.0		
				11.7	43.0	5.0		
Bi_2Te_3/G	0.3-2.8	83.5	498/416	312.9	488.1	0.1	500	This work
				302.9	472.5	0.2		
				275.2	429.3	0.5		
				252.2	393.4	1.0		
				229.2	357.6	2.0		
				203.1	316.8	5.0		

Table S3 Fitting results of the EIS curves for the pure Bi_2Te_3 and Bi_2Te_3/G composite.

Samples	R_e (Ω)	R_f (Ω)	R_{ct} (Ω)	σ (Ω $rad^{1/2}$ $s^{-1/2}$)	D (cm^2 S^{-1})
Bi_2Te_3	14.3	12.5	49.10	93.59	2.36E-18
Bi_2Te_3/G	13.21	12.64	18.22	48.07	1.45E-16

References

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