Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Cobalt Telluride/Graphene Composite Nanosheets for Excellent Gravimetric and Volumetric Na-Ion Storage

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Supporting Data:

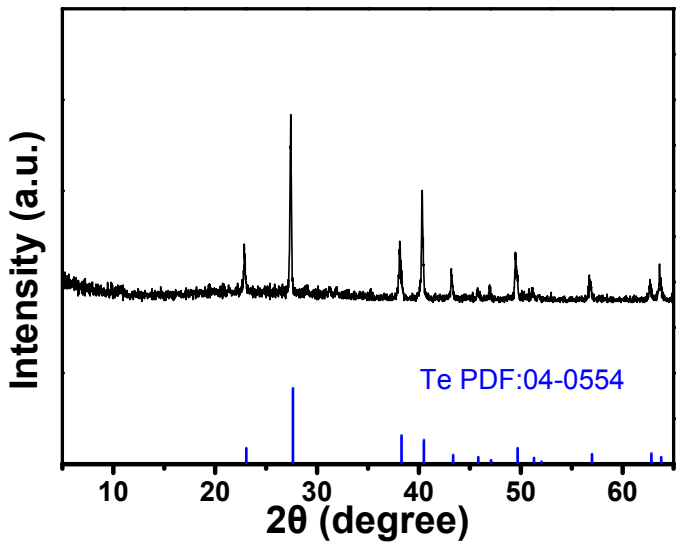

Fig. S1. XRD pattern of the intermediates obtained at the molar ratio of $Co(AC)_2$ and Na_2TeO_3 is 0.5:1 at 180 °C for 3h.

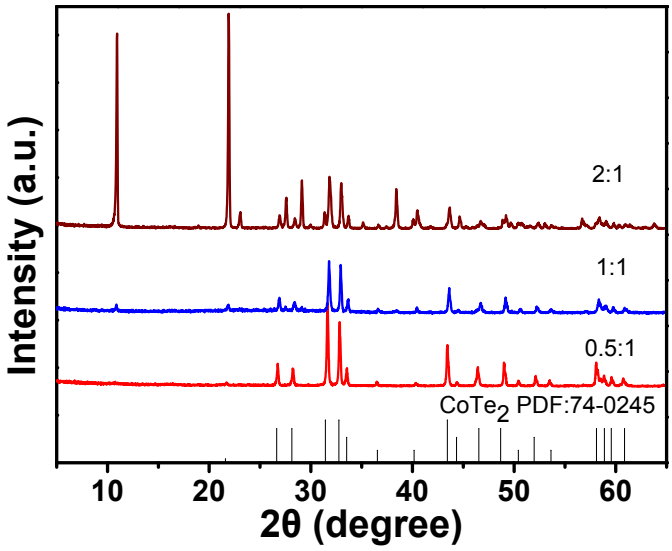

Fig. S2. XRD patterns of the $CoTe_2$ obtained at the molar ratio of $Co(AC)_2$ and Na_2TeO_3 is 0.5:1, 1:1, 2:1.

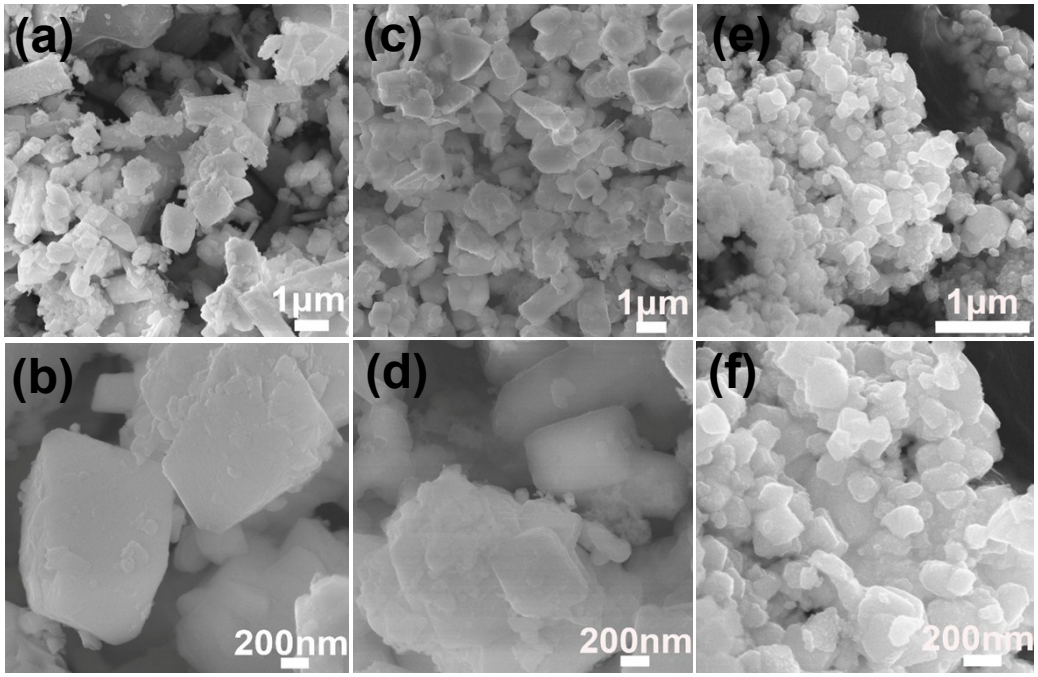

Fig. S3. SEM images of the $CoTe_2$ obtained at the molar ratio of $Co(AC)_2$ and Na_2TeO_3 a,b) 2:1; c,d) 1:1; e,f) 0.5:1.

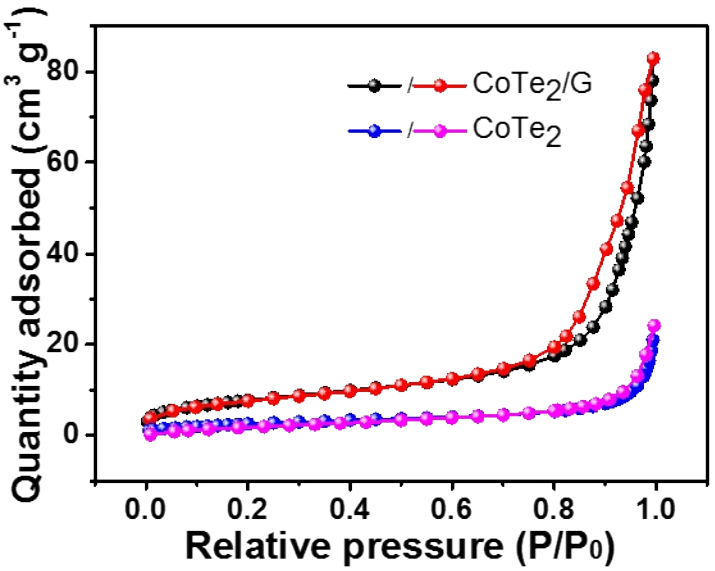

Fig. S4. N_2 adsorption-desorption isotherms of and $CoTe_2$ and $CoTe_2$/G composite.

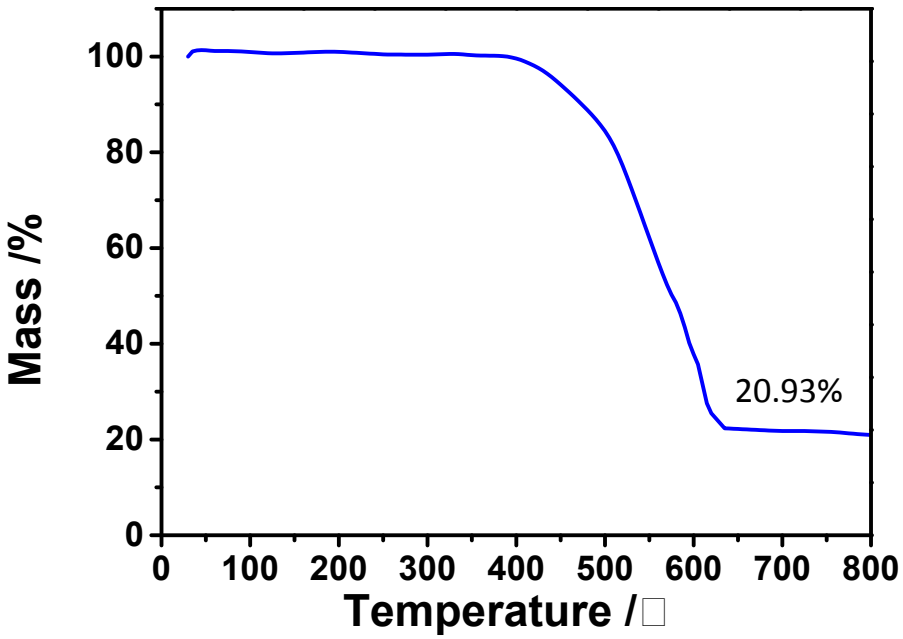

Fig. S5. TG curve of the $CoTe_2$/G composite obtained in air atmosphere from room temperature to 800 °C at a rate of 10 °C/min.

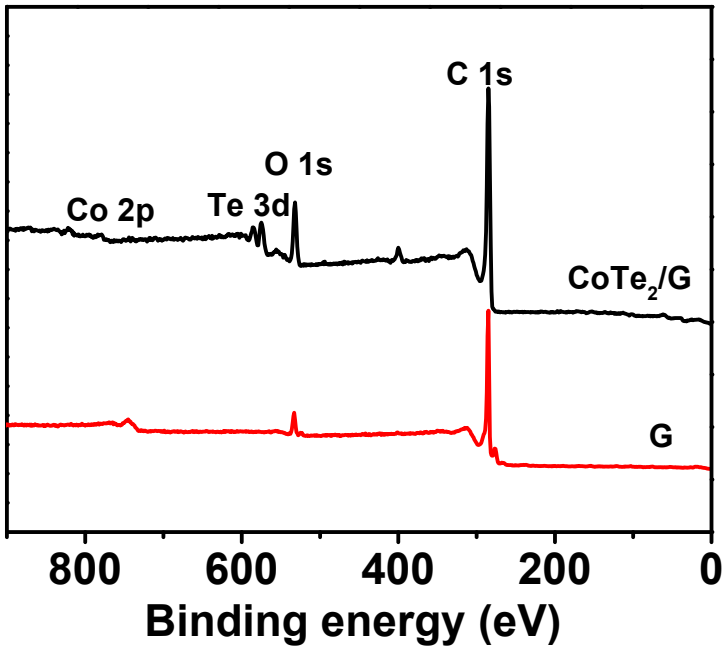

Fig. S6. XPS survey spectra of the $CoTe_2$/G composite and graphene.

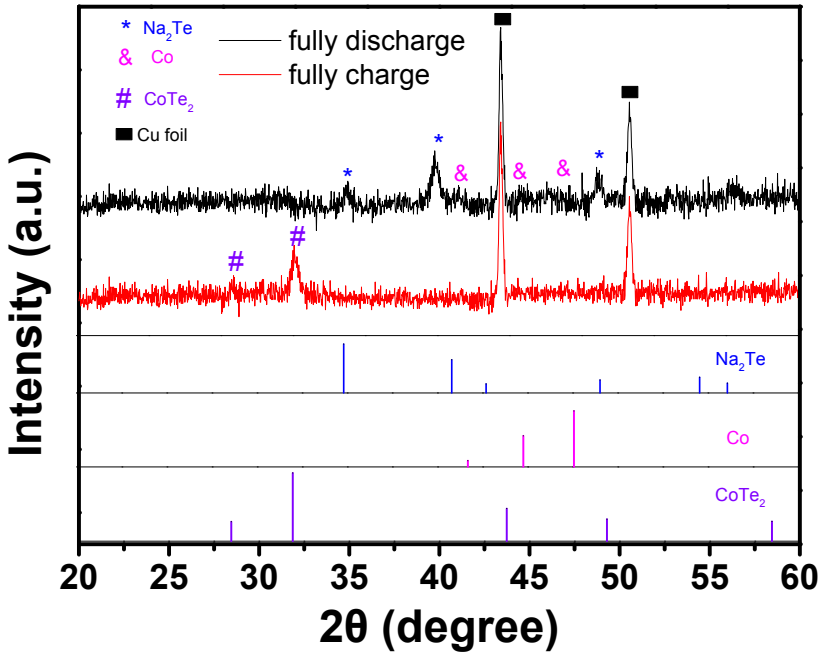

Fig. S7. Ex situ XRD patterns of the $CoTe_2$/G composite electrode materials at the state of fully discharged to 0.01 V and charged to 2.8 V during the first cycle process, respectively.

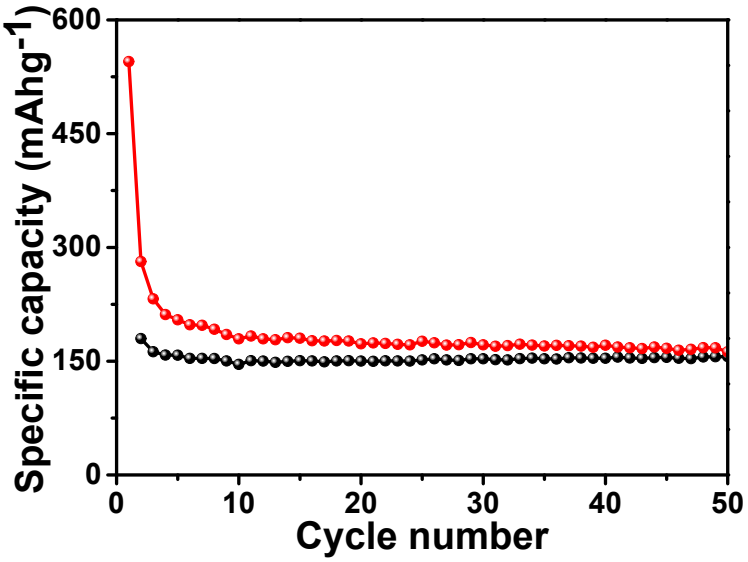

Fig. S8. Cycle properties of graphene nanosheets obtained by removal of $CoTe_2$ in the $CoTe_2$/G composite of SIBs at 0.05 A g^{-1}.

According to TG analysis, the graphene content in the composite is estimated to be approximately 18.1 wt %. In SIBs, the reversible capacity of $CoTe_2$/G is ca. 382 mA h g^{-1} and the reversible capacity of graphene is ca. 180 mA h g^{-1}, so the capacity of graphene in composite film is ca. 33 mA h g^{-1}, and the capacity of $CoTe_2$ in composite is ca. 349 mA h g^{-1}. Thus the actual deliverable specific reversible capacity of $CoTe_2$ is 426 mA h g^{-1}.

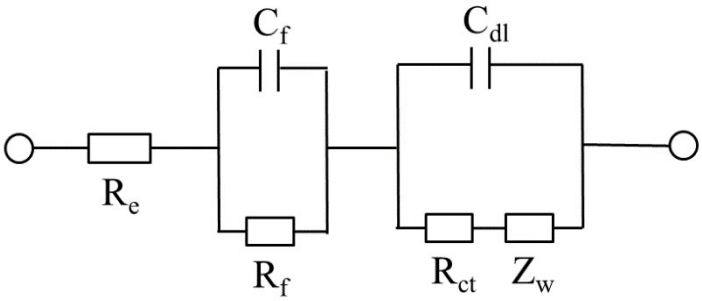

Fig. S9. Equivalent circuit.

R_e is the electrolyte resistance; C_f and R_f are the capacitance and resistance of the surface 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 lithium ions into the bulk electrodes.

Table S1. The fitting results of the EIS curves for the $CoTe_2$ and $CoTe_2$/G composite.

Sample	SIBs		
	R_e (Ω)	R_f (Ω)	R_{ct} (Ω)
CoTe2	12.97	29.74	56.77
CoTe2/G	10.26	21.52	41.29

Table S2. Electrochemical performance comparison for metal telluride materials as electrode materials for SIBs.

materials	Voltage range (v)	Current density	Initial reversible capacity	Initial coulombic efficiency (%)	Cycle performance	Rate performance	Ref
FeTe2-rGO composite	0.001-3.0	200 mA/g	373 mA h/g	76 %	293 mA h/g mA h/g at 200 mA/g after 80 cycle	421 mA h/g at 0.1 A/g 384 mA h/g at 0.5 A/g 362 mA h/g at 1 A/g 321 mA h/g at 2 A/g 257 mA h/g at 3 A/g	1
C@MoTe2	0.001-3.0	1 A/g	279 mA h/g	71.9 %	286 mA h/g at 1 A/g after 200 cycle	343 mA h/g at 0.2 A/g 306 mA h/g at 0.5 A/g 280 mA h/g at 1 A/g 254 mA h/g at 2 A/g 236 mA h/g at 3 A/g 209 mA h/g at 5 A/g	2
SnTe/C	0.001-2.5	100 mA/g	339 mA h/g (685 mA h cm^{-3})	62.7 %	316 mA h/g (639 mA h cm^{-3}) at 50 mA/g after 100 cycle	-	3
C@Cu1.75Te	0.005-3.0	100 mA/g	314 mA h/g	37.3 %	177.5 mA h/g at 100 mA/g after 500 cycle	245.2 mA h/g at 0.2 A/g 127.8 mA h/g at 0.5 A/g 68.1 mA h/g at 1 A/g 44.4 mA h/g at 3 A/g	4
CoTe2/G	0.01-2.8	50 mA/g	382 mA h/g (695.2 mA h cm^{-3})	78.1%	356 mA h/g (647.9 mA h cm^{-3}) at 50 mA/g after 100 cycle	351 mA h/g at 0.1 A/g 336 mA h/g at 0.2 A/g 314 mA h/g at 0.5 A/g 295 mA h/g at 1 A/g 272mA h/g at 2 A/g 246 mA h/g at 5 A/g	This work

References

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