

SUPPORTING INFORMATION

Ga₂Te₃-Based Composite Anodes for High-Performance Sodium-Ion Batteries

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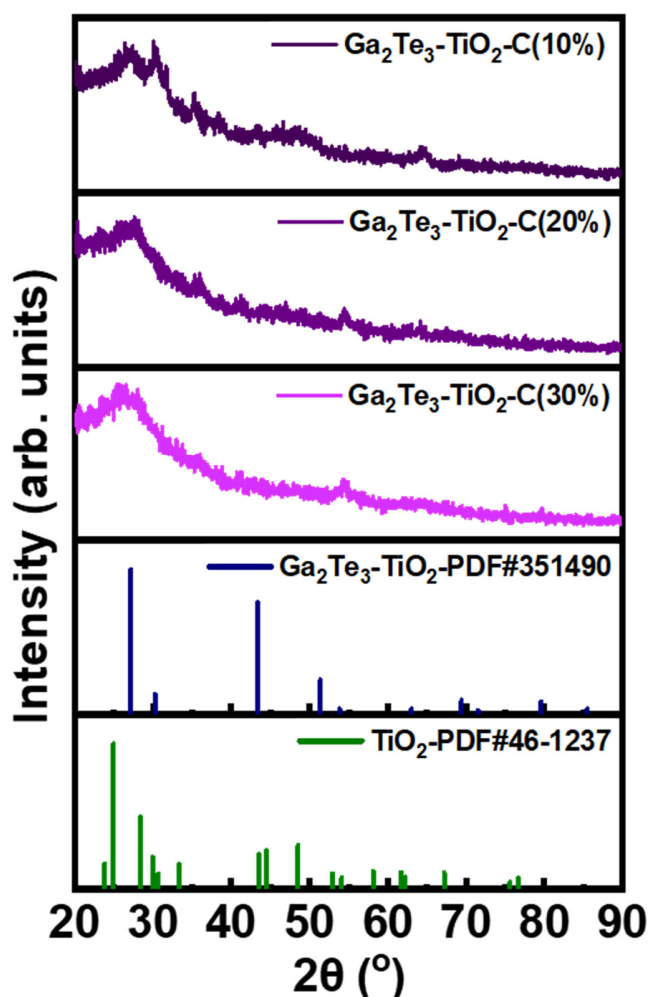


Figure S1. XRD pattern of Ga₂Te₃-TiO₂-C with different concentration of C.

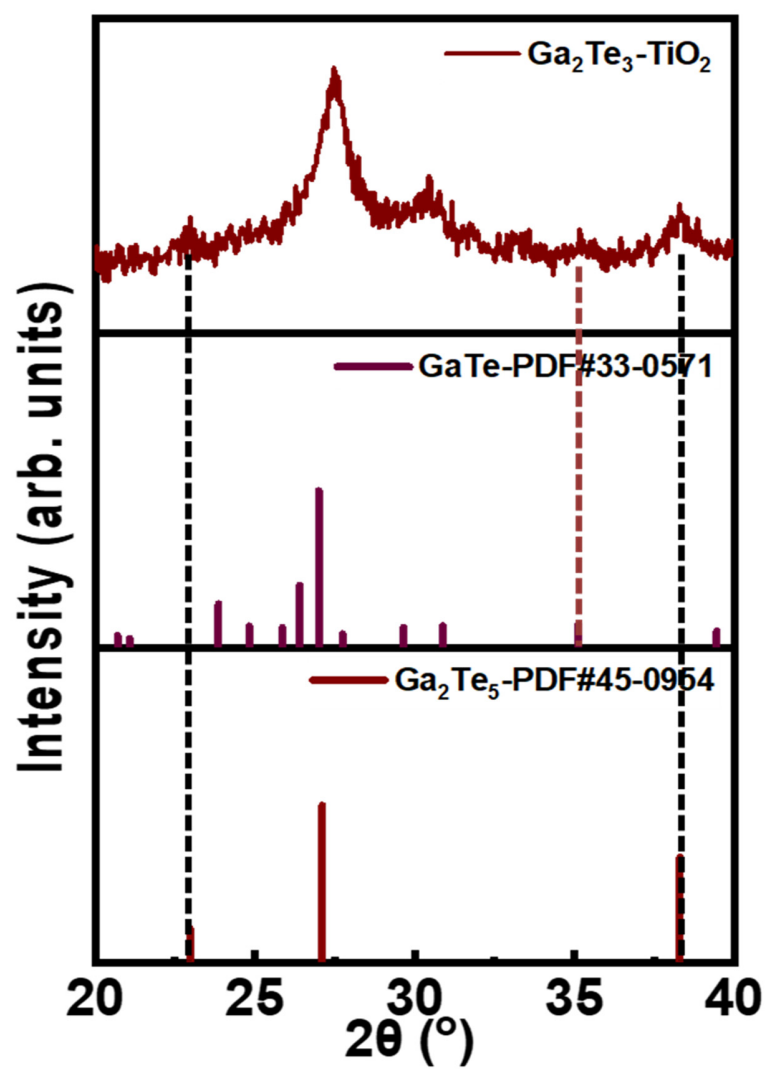


Figure S2. The existence of different forms of Ga_xTe_y (namely, Ga_2Te_5 and GaTe).

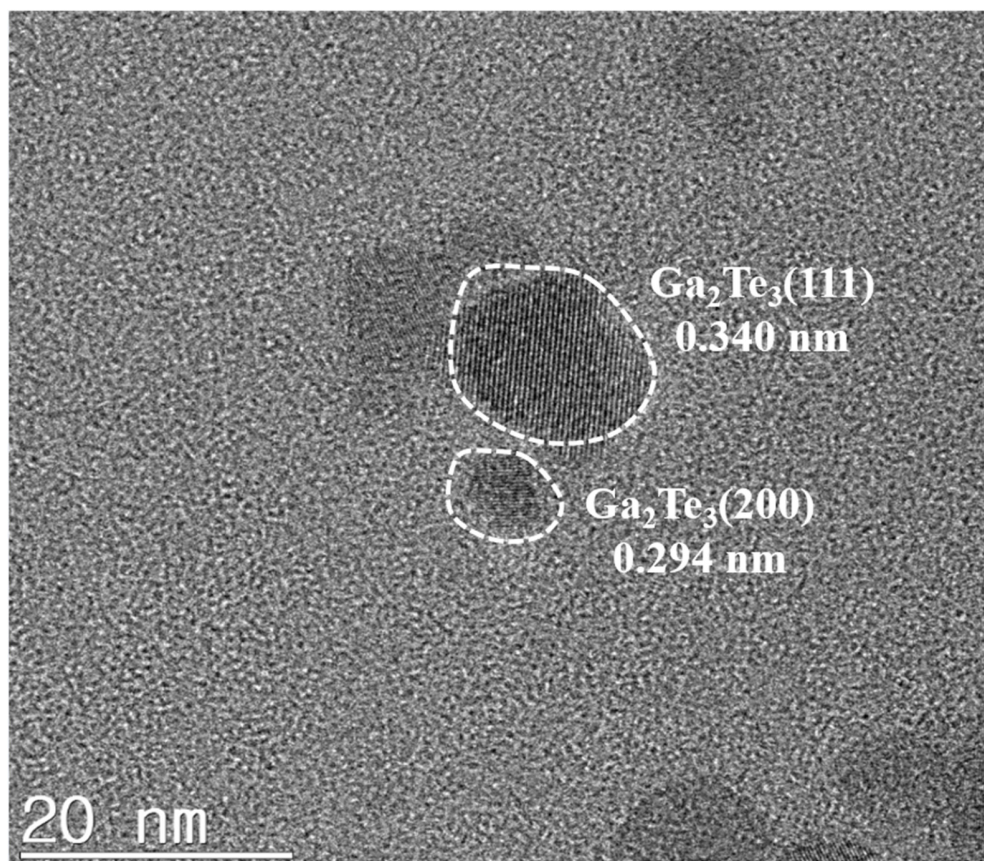


Figure S3. HRTEM image of Ga₂Te₃-TiO₂-C(10%).

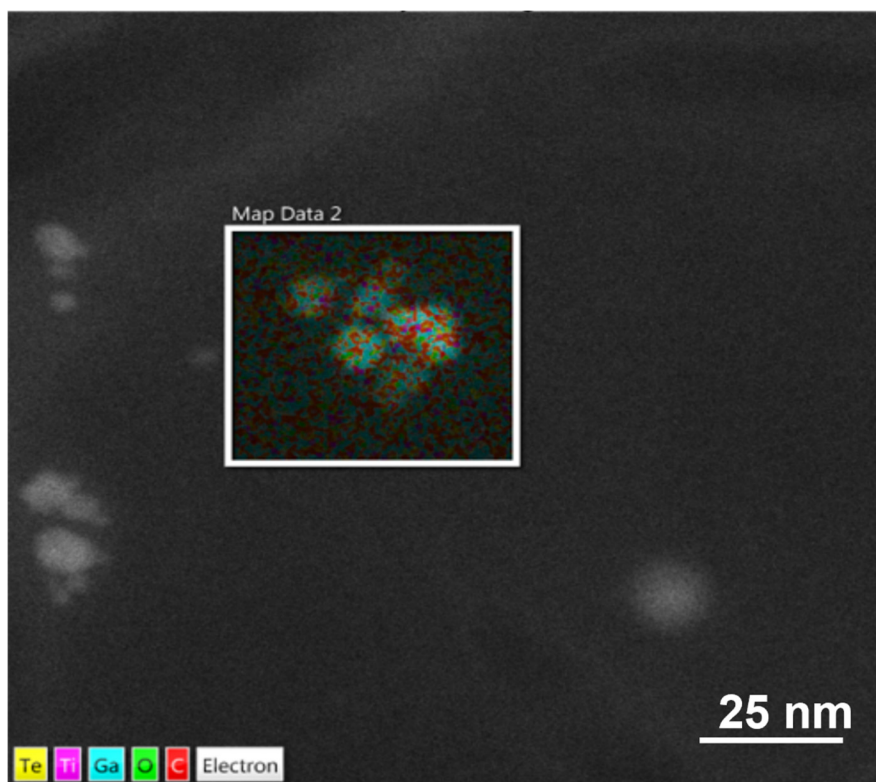


Figure S4. SEM image of distribution of the elements in Ga₂Te₃-TiO₂-C(10%).

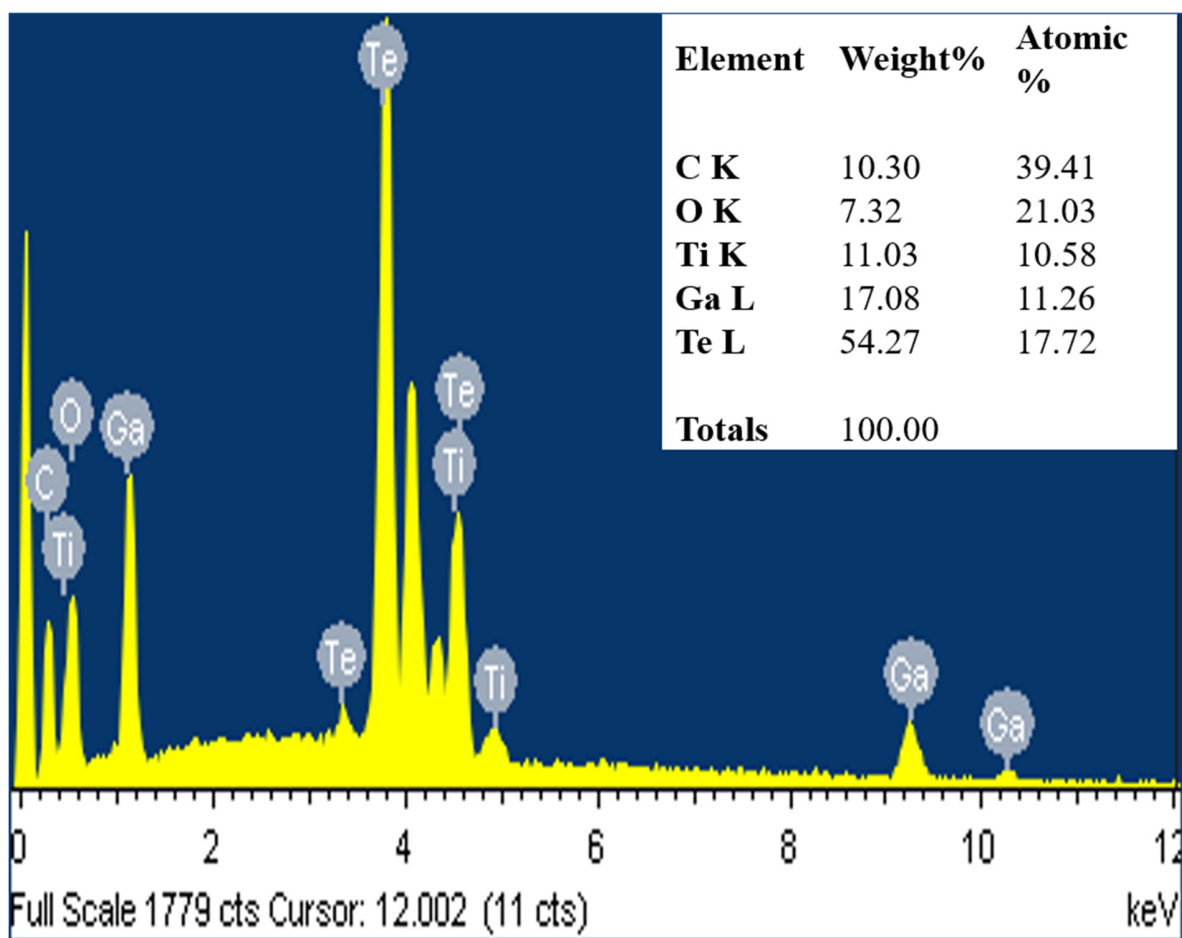


Figure S5. EDX spectrum of as-synthesized $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C(10\%)}$.

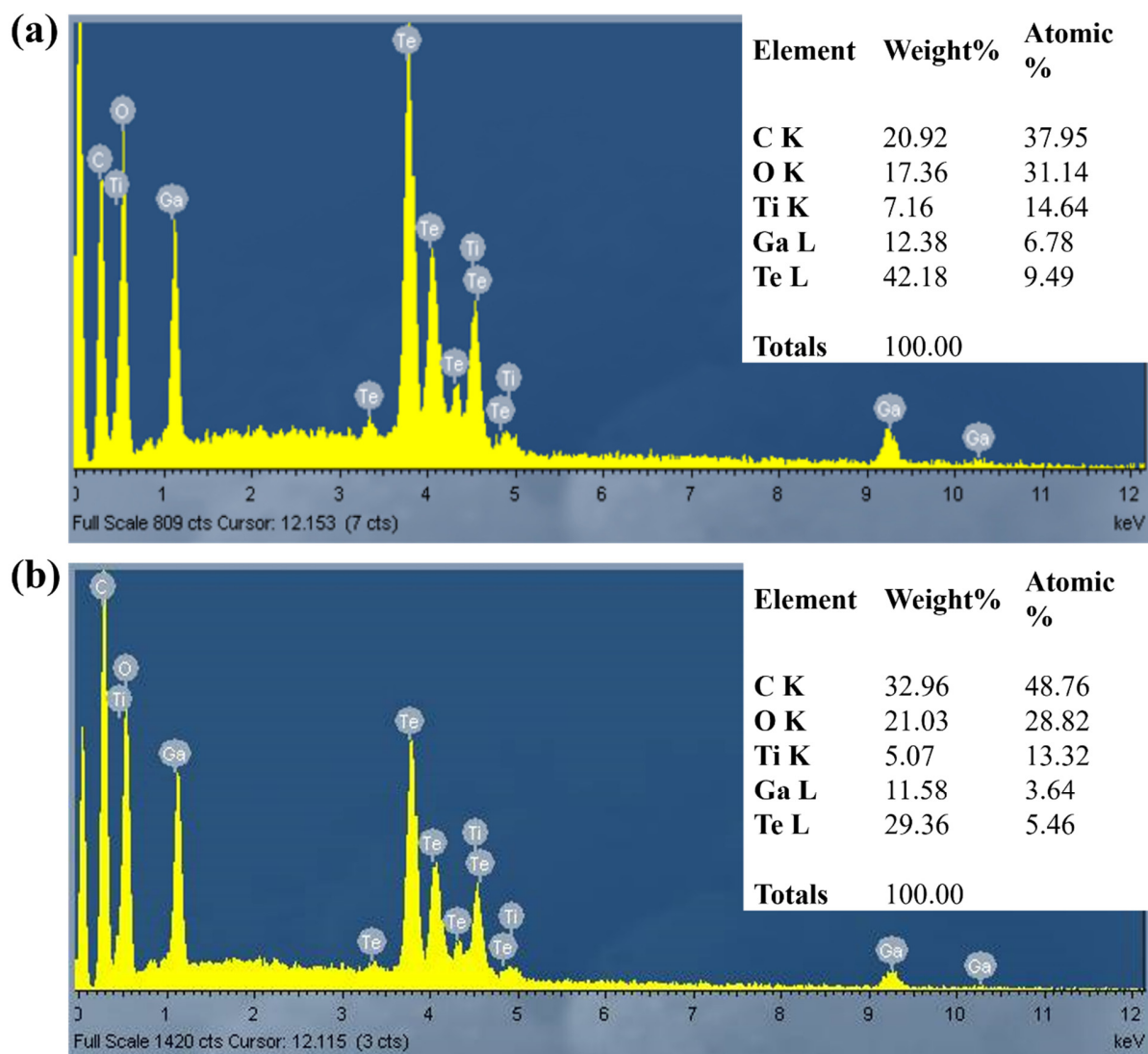


Figure S6. EDX analysis of (a) $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C}(20\%)$, and (b) $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C}(30\%)$.

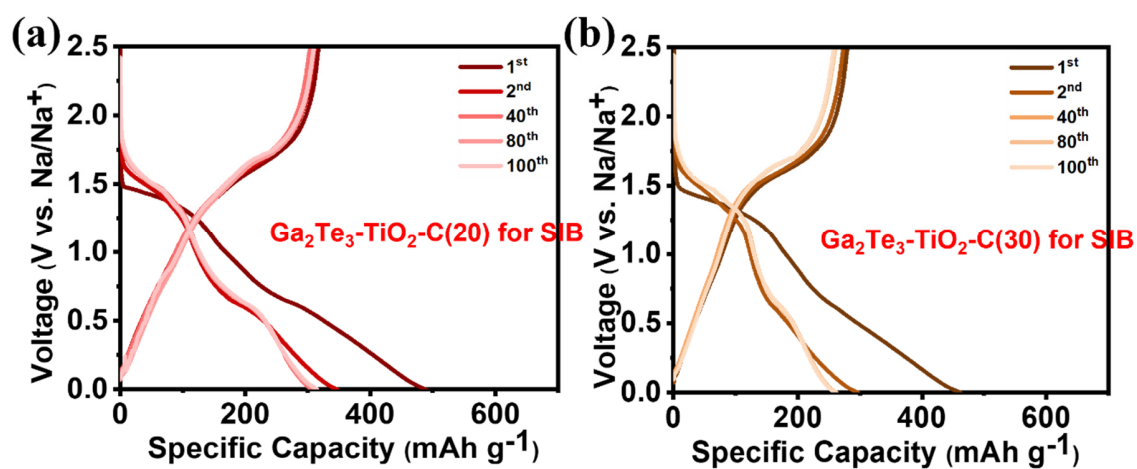


Figure S7. Galvanostatic discharge-charge profiles of (a) $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C}(20\%)$ and (b) $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C}(30\%)$ for SIBs.

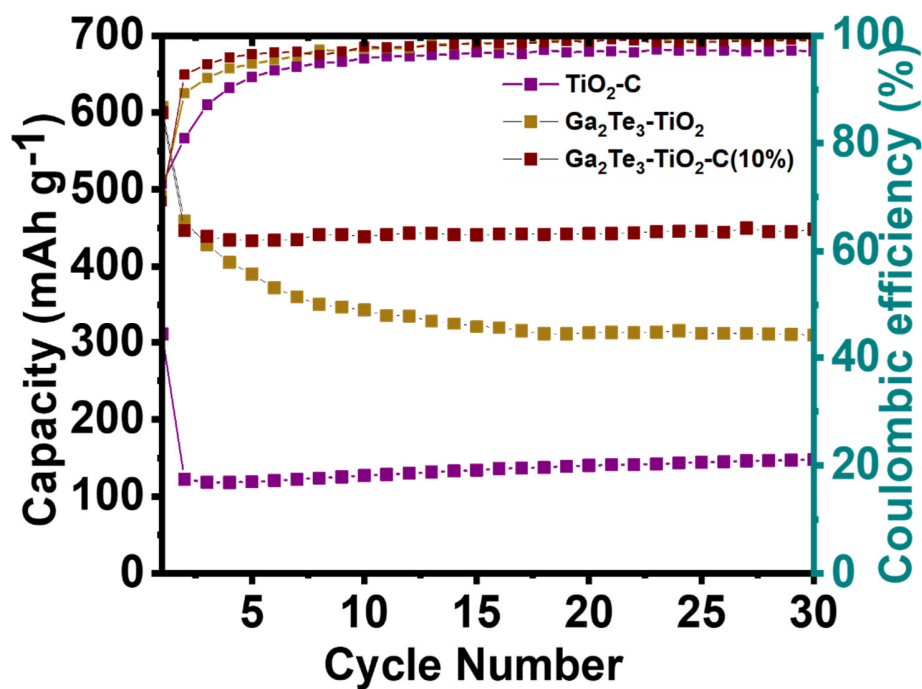


Figure S8. Cyclic performance of various electrodes at 100 mA g^{-1} .

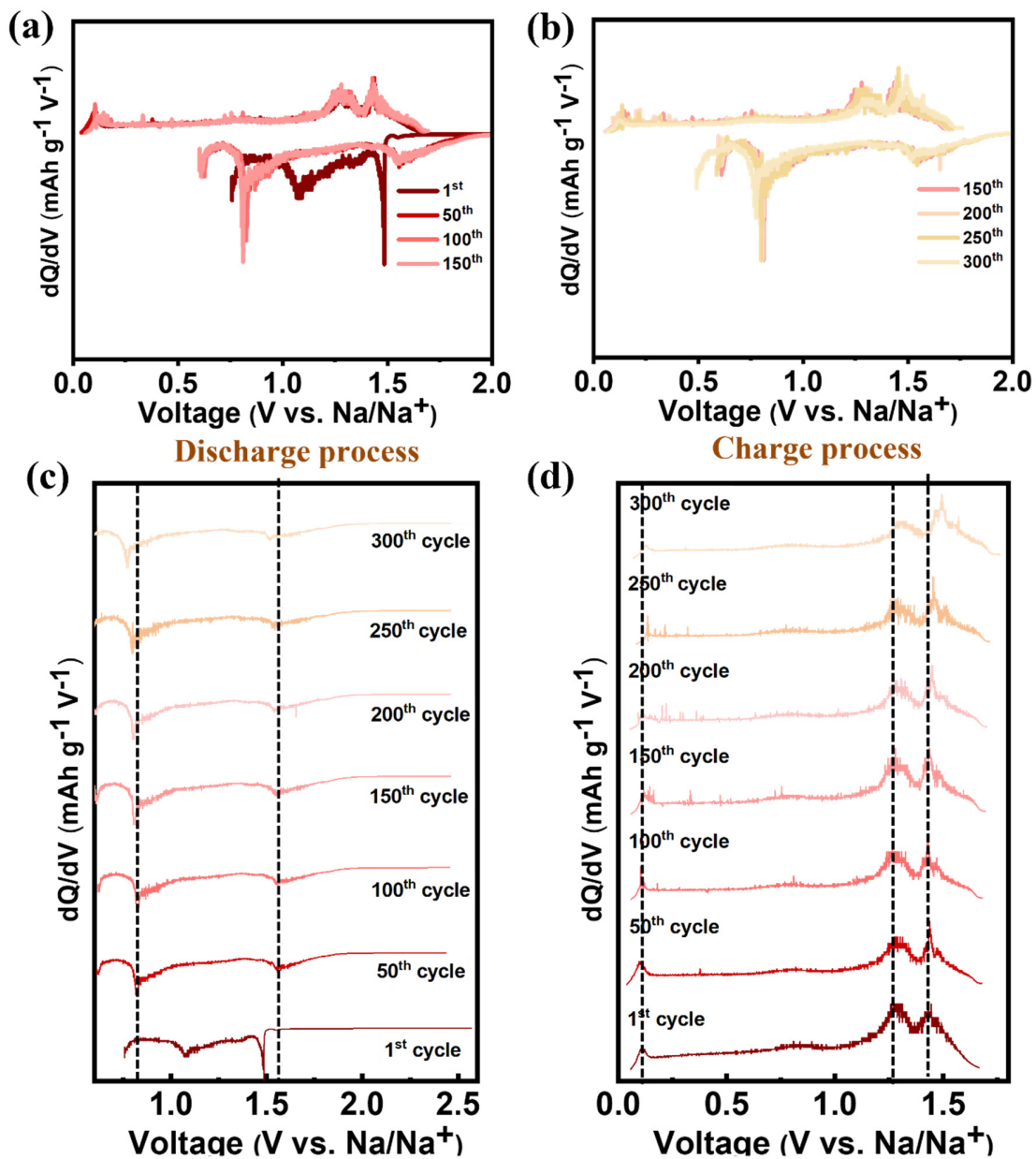


Figure S9. DCP profiles of Ga₂Te₃-TiO₂-C(10%) during 300 cycles measured at 100 mA g⁻¹: (a) 1–150 cycles, (b) 150–300 cycle. Enlarged view of (c) reduction and (d) oxidation peaks.

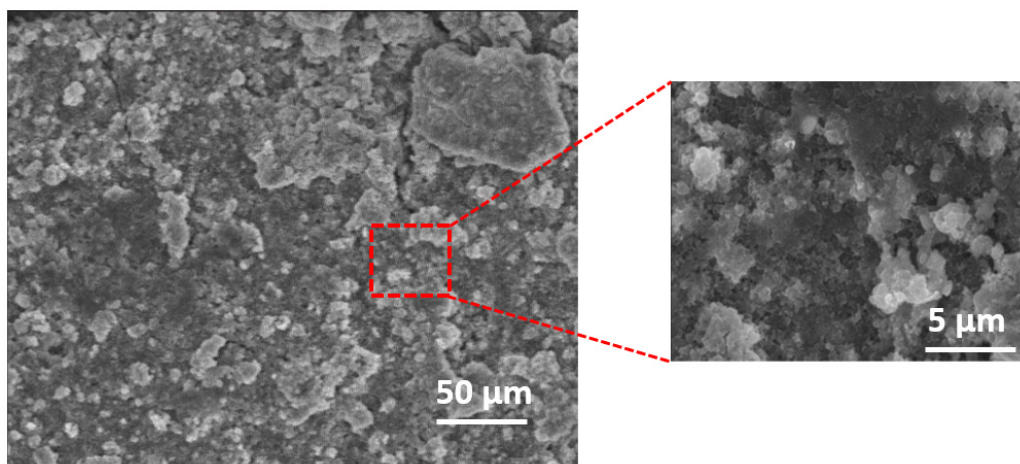


Figure S10. SEM image of $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C(10\%)}$ after 300 cycles.

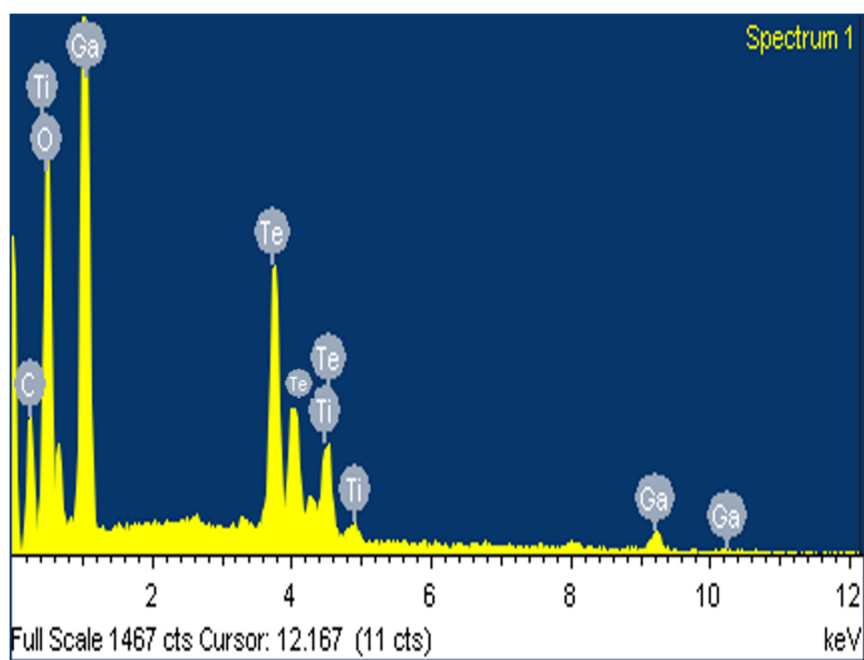


Figure S11. EDX analysis of $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C(10\%)}$ after 300 cycles.

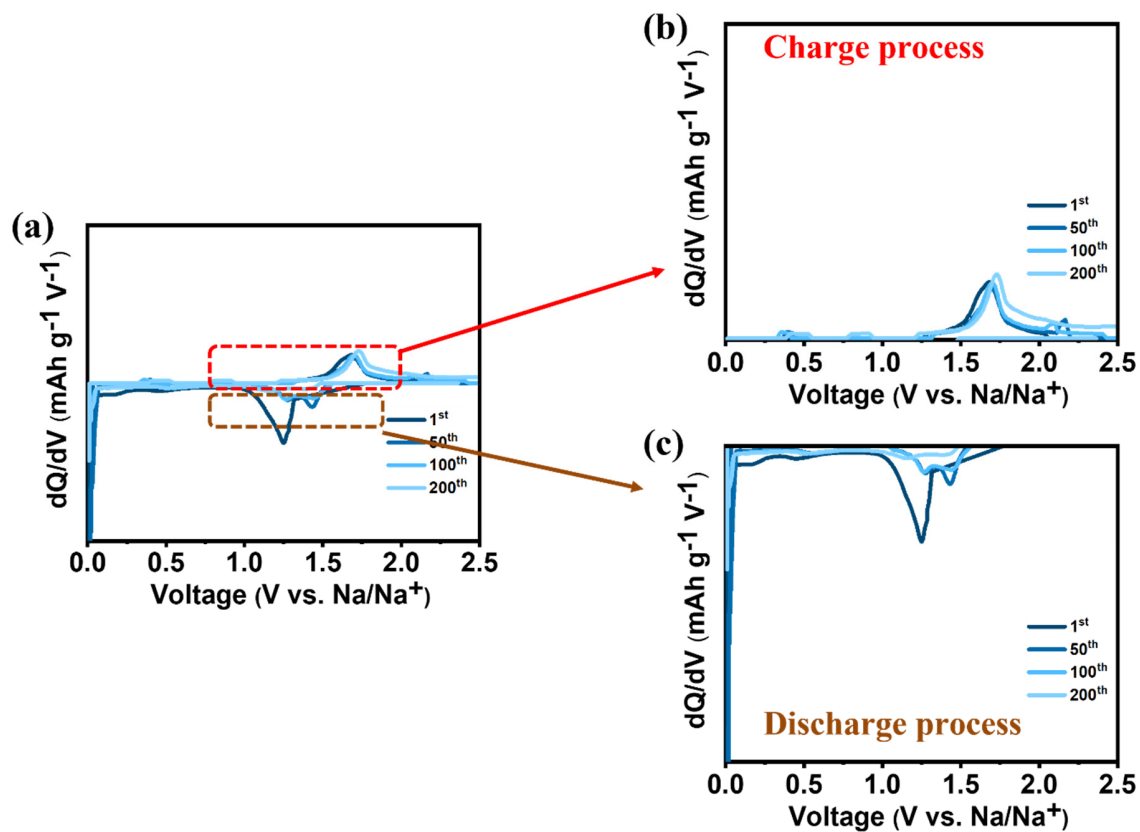


Figure S12. (a) DCP profiles of Ga₂Te₃-TiO₂-C(10%) during initial 200 cycles measured at 500 mA g⁻¹. Enlarged view of (b) oxidation and (c) reduction peaks.

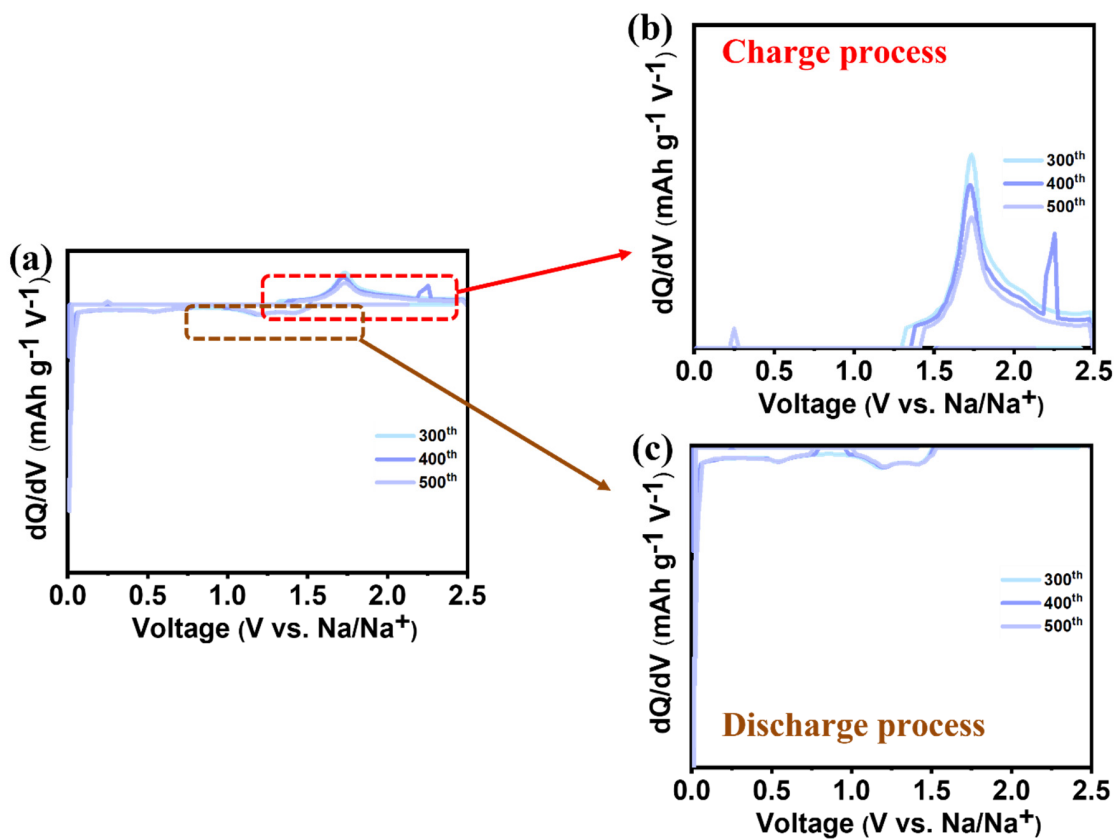


Figure S13. (a) DCP of $\text{Ga}_2\text{Te}_3\text{-TiO}_2\text{-C(10\%)}$ from 300 cycle to 500 cycles measured at 500 mA g^{-1} . Enlarged view of (b) oxidation and (c) reduction peaks.

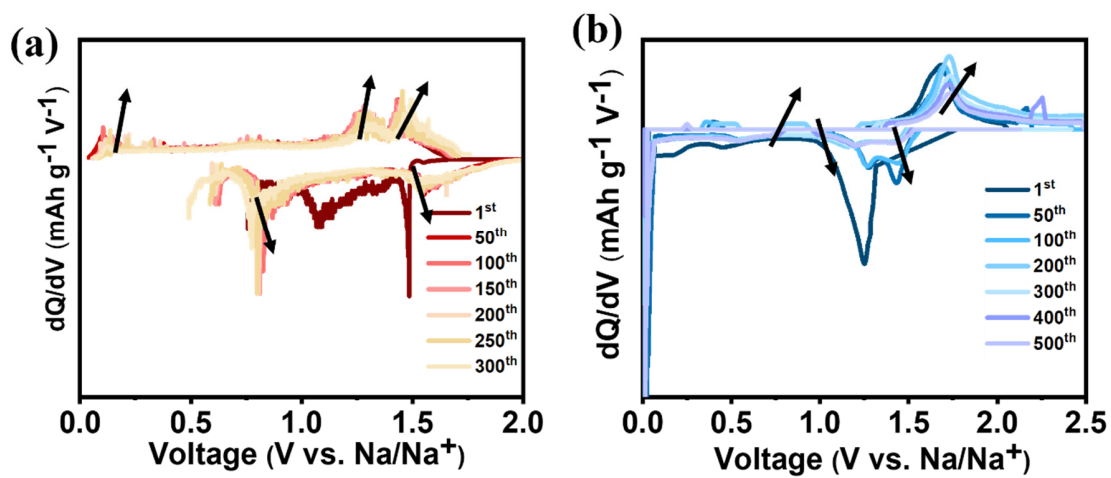


Figure S14. DCP profiles of Ga₂Te₃-TiO₂-C(10%) (a) at 100 mA g⁻¹ during 300 cycles and (b) at 500 mA g⁻¹ during 500 cycles.

(a) Current density: 100 mA g⁻¹ **(b) Current density: 500 mA g⁻¹**

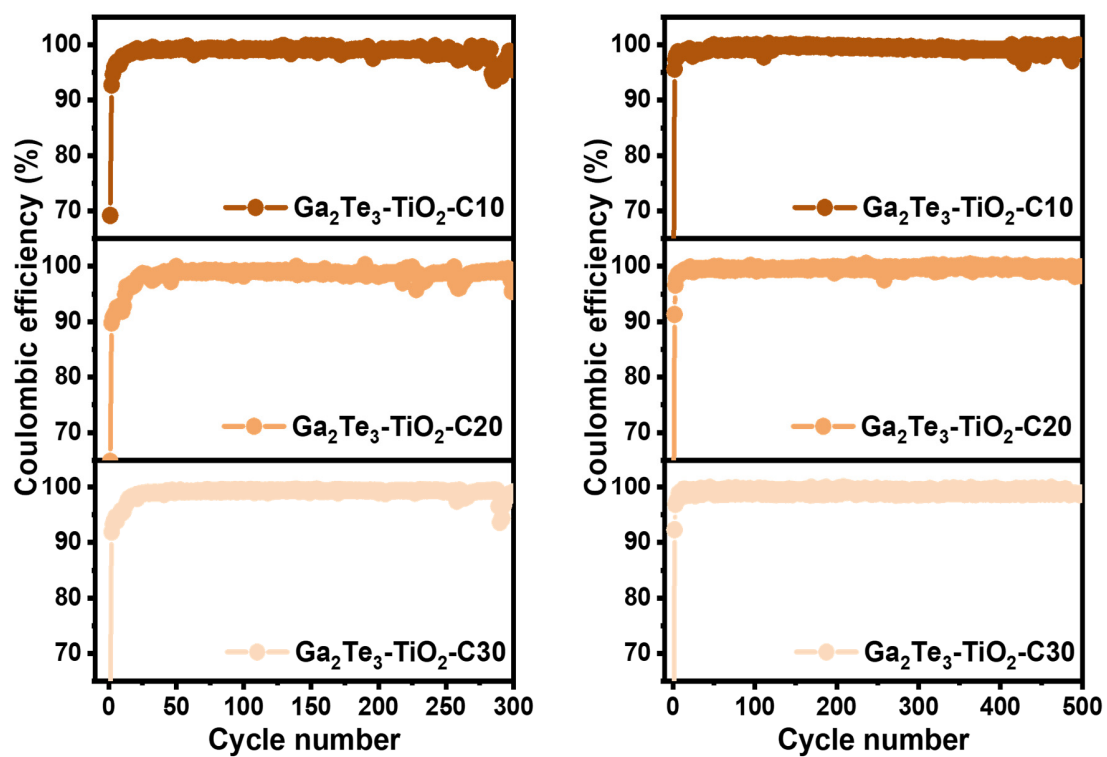


Figure S15. Coulombic efficiency of Ga₂Te₃-TiO₂ with different C content at current densities of (a) 100 and (b) 500 mA g⁻¹.

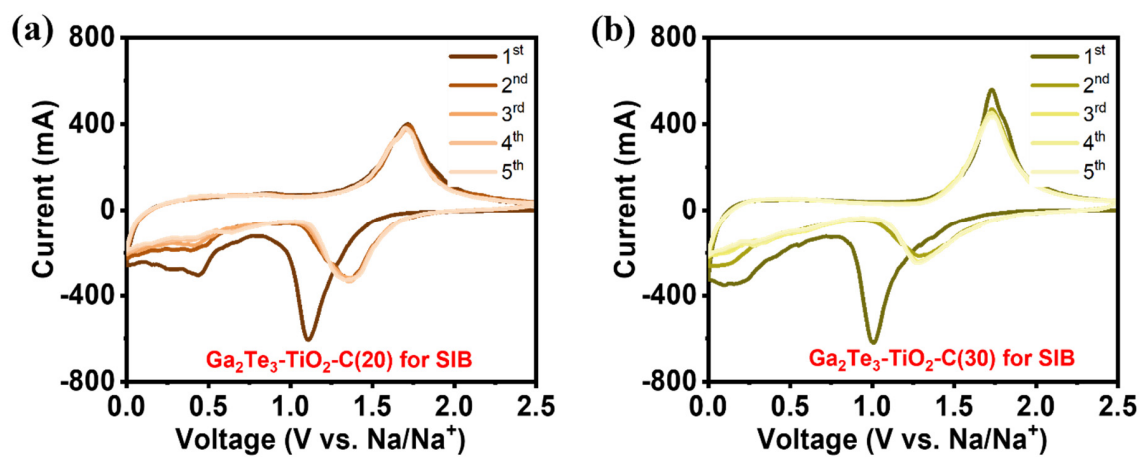


Figure S16. (a) CV curves of Ga₂Te₃-TiO₂-C (20%), and (b) Ga₂Te₃-TiO₂-C (30%) for SIBs.

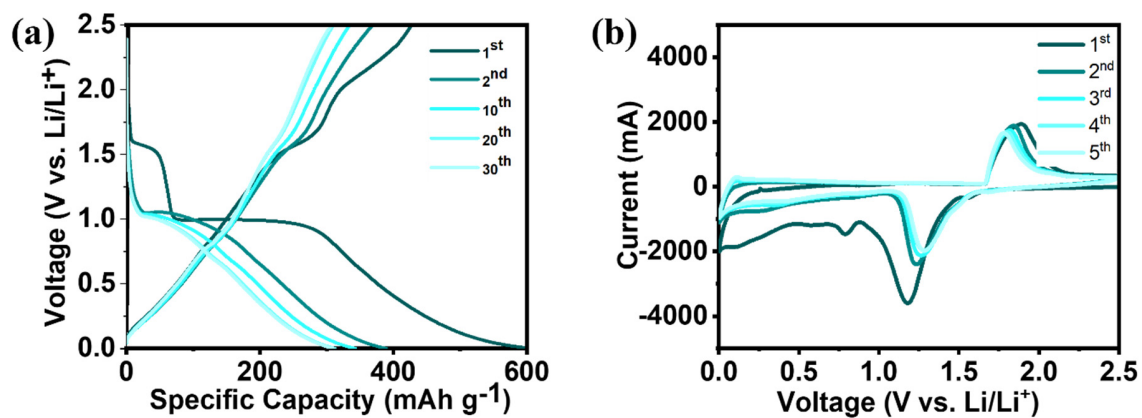


Figure S17. (a) Galvanostatic discharge-charge profiles of $\text{Ga}_2\text{Te}_3\text{-TiO}_2$ at a current density of 100 mA g^{-1} , (b) CV curves of $\text{Ga}_2\text{Te}_3\text{-TiO}_2$.

Table S1. Rate performance of Te-based composite anode for SIB

Anode	Rate capability	Capacity retention (%)	Ref.
Ga ₂ S ₃ -C	94 mAh g ⁻¹ at 2.0 A g ⁻¹	78	[35]
Bi ₂ Te ₃	339.40 mAh g ⁻¹ at 10.0 A g ⁻¹	96	[36]
Sb ₂ Te ₃ -Te	226 mAh g ⁻¹ at 15 A g ⁻¹	95	[37]
NiTe ₂ @N-doped carbon nanosheet	267 mAh g ⁻¹ at 10.0 A g ⁻¹	95	[38]
FeTe ₂ @rGO	257 mAh g ⁻¹ at 3.0 A g ⁻¹	93	[39]
SbTe@C	413 mAh g ⁻¹ at 2.0 A g ⁻¹	97	[40]
SnTe@C	117 mAh g ⁻¹ at 1.0 A g ⁻¹	85	[41]
MoTe ₂	185 mAh g ⁻¹ at 5.0 A g ⁻¹	91	[42]
MoTe ₂ @3D porous carbon network	213 mAh g ⁻¹ at 20.0 A g ⁻¹	56	[43]
CoTe ₂ @N-doped multichannel carbon fiber	152 mAh g ⁻¹ at 10 A g ⁻¹	91	[44]

Table S2. Calculation of capacity contribution of Ga₂Te₃, TiO₂ and C in the Ga₂Te₃-TiO₂-C composite for SIB.

	Ga ₂ Te ₃	TiO ₂	C
The mole of Na-ion participating reaction	6.5	1	0.17
Molecular weight (g mol ⁻¹)	522.24	79.9	12
Calculated theoretical capacity (mAh g ⁻¹)	~333	~336	~380
Actual weight faction in the Ga ₂ Te ₃ -TiO ₂ -C composite	0.66	0.22	0.11
Contributed capacity (mAh g ⁻¹)	220	74	42
Capacity contribution (%)	65	22	13

Table S3. Calculation of theoretical capacity of Ga₂Te₃-TiO₂-C(10%) and Ga₂Te₃-TiO₂ for SIB

Anode materials	Ga ₂ Te ₃ -TiO ₂ -C(10%)			Ga ₂ Te ₃ -TiO ₂		
Component	Ga ₂ Te ₃	TiO ₂	C	Ga ₂ Te ₃	TiO ₂	C
Theoretical weight faction	0.66	0.22	0.11	0.80	0.20	-
Theoretical capacity (mAh g ⁻¹)	~333	~336	~380	~333	~336	~380
Contributed theoretical capacity (mAh g ⁻¹)	~220	~74	~42	~266	~67	-
Total theoretical capacity (mAh g ⁻¹)		~336			~333	

Table S4. Coulombic efficiency variation of Ga₂Te₃-TiO₂-C (10%) at various cycle numbers measured at 100 mA g⁻¹ for SIB

Cycle number	Coulombic efficiency (%)
1	69.18
10	97.92
20	98.82
50	99.30
100	99.30
150	99.82
200	98.69
250	98.84
300	98.49

Table S5. Coulombic efficiency variation of Ga₂Te₃-TiO₂-C (10%) at various cycle numbers measured at 500 mA g⁻¹ for SIB

Cycle number	Coulombic efficiency (%)
1	59.18
10	98.64
20	99.29
50	99.99
100	99.05
200	99.69
300	99.30
400	99.12
500	99.59

Table. S6 Coulombic efficiency of Ga₂Te₃-TiO₂-C at current density of 100 mA g⁻¹ during initial 10 cycles for SIB

Cycle number	Coulombic efficiency (%)		
	Ga ₂ Te ₃ -TiO ₂ -C (10%)	Ga ₂ Te ₃ -TiO ₂ -C (20%)	Ga ₂ Te ₃ -TiO ₂ -C (30%)
1st	69.18	64.80	60.47
2nd	92.74	89.79	91.86
3rd	94.68	90.82	93.29
4th	95.94	91.34	94.05
5th	96.54	91.69	94.62
6th	96.87	92.54	93.87
7th	96.95	92.44	94.66
8th	96.42	92.79	95.21
9th	96.97	91.93	95.72
10th	97.92	91.89	95.33

Table. S7 Coulombic efficiency of Ga₂Te₃-TiO₂-C at current density of 500 mA g⁻¹ during initial 10 cycles for SIB

Cycle number	Coulombic efficiency (%)		
	Ga ₂ Te ₃ -TiO ₂ -C (10%)	Ga ₂ Te ₃ -TiO ₂ -C (20%)	Ga ₂ Te ₃ -TiO ₂ -C (30%)
1st	59.18	58.93	48.40
2nd	95.59	91.31	92.28
3rd	97.38	96.61	96.82
4th	98.09	97.86	97.18
5th	97.75	98.22	97.73
6th	98.71	98.56	97.92
7th	98.38	98.47	98.84
8th	98.19	98.85	97.92
9th	98.33	98.83	98.69
10th	98.64	97.92	98.22

Table. S8. Charge-transfer resistance (R_{ct}) of Ga₂Te₃-TiO₂-C for SIB

	Ga₂Te₃-TiO₂-C (10%)	Ga₂Te₃-TiO₂-C (20%)	Ga₂Te₃-TiO₂-C (30%)
1 cycle	100.4 Ω	180.72 Ω	130.7 Ω
5 cycles	125.6 Ω	148.8 Ω	183.3 Ω
20 cycles	99.41 Ω	124.4 Ω	133.7 Ω