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Ultrafast-charging and long cycle-life anode materials of TiO_2-bronze/nitrogen-doped graphene nanocomposites for high-performance lithium-ion batteries

Thanapat Autthawong,[a] Yothin Chimupala,[b,e] Mitsutaka HARUTA,[c] Hiroki KURATA,[c] Tsutomu KIYOMURA,[c] Ai-shui YU,[d] Torranin Chairuangsri[b] and Thapanee Sarakonsri*[,a,e]

[a] *Department of Chemistry, Faculty of Science, Chiang Mai University, Muang, Chiang Mai 50200, Thailand. E-mail: tsarakonsri@gmail.com*
[b] *Department of Industrial Chemistry, Faculty of Science, Chiang Mai University, Muang, Chiang Mai 50200, Thailand.*
[c] *Institute for Chemical Research, Kyoto University, Uji, Kyoto 611-0011, Japan.*
[d] *Department of Chemistry, Fudan University, Yangpu, Shanghai 200438, China.*
[e] *Material Science Research Center, Faculty of Science, Chiang Mai University, Muang, Chiang Mai 50200, Thailand.*

SUPPLEMENTARY INFORMATION

Fig. **S1** Schematic diagram of experimental steps for the synchronous preparation of TNG nanocomposites via the hydrothermal method and followed by heat-treatment process.

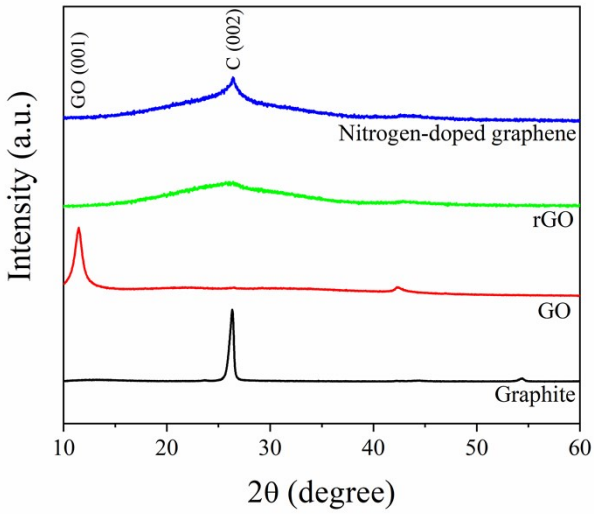

Fig. **S2** Powder XRD patterns measured in a range of 2θ from 10° to 60° of graphite, GO, rGO, and nitrogen-doped graphene.

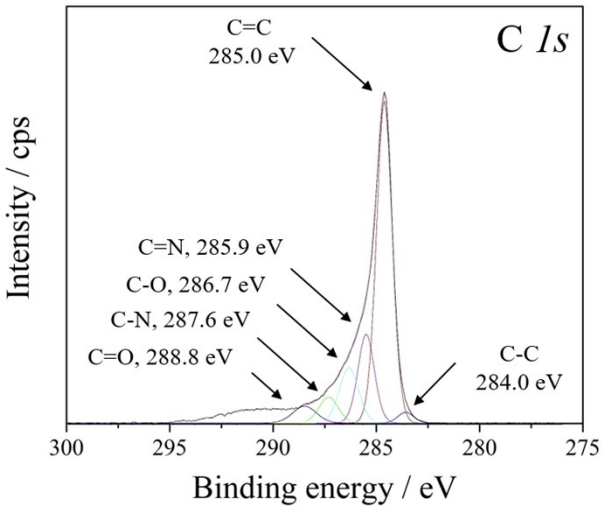

Fig. **S3** the high magnified curve fitting of C 1s XPS spectra

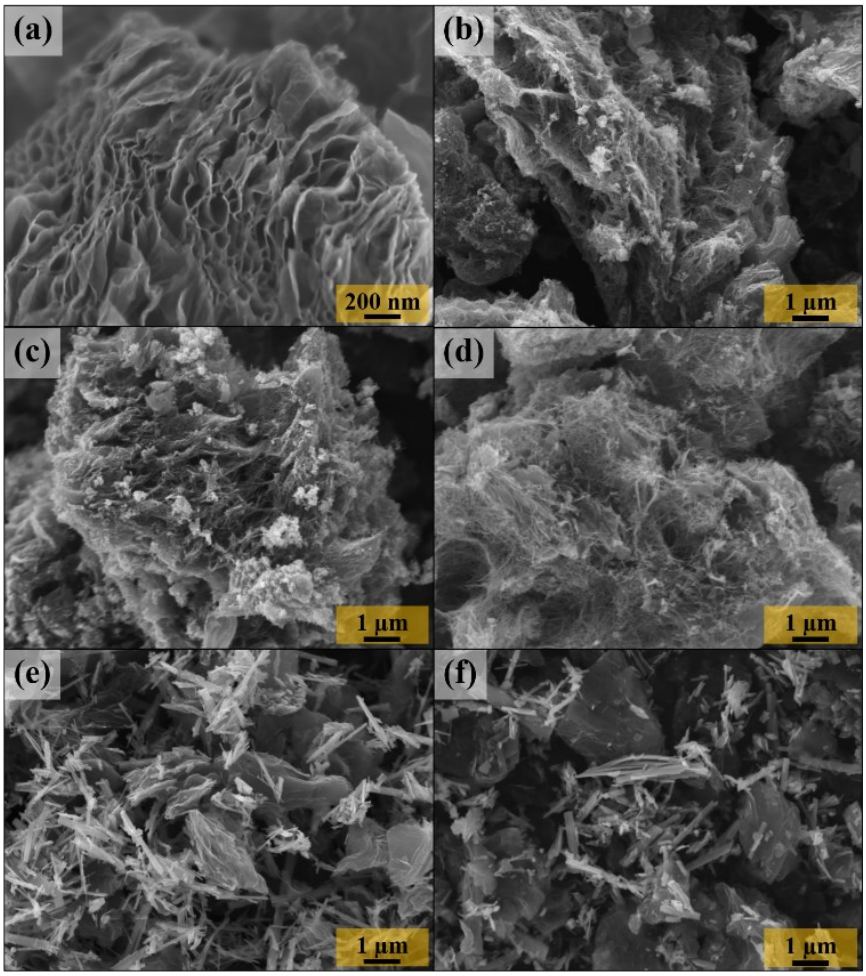

Fig. **S4** SEM images of (a) nitrogen-doped graphene, and TNG products, (b) TNG-3h, (c) TNG-6h, (d) TNG-9h, (e) TNG-12h, and (f) TNG-24h, which were prepared from different hydrothermal reaction times.

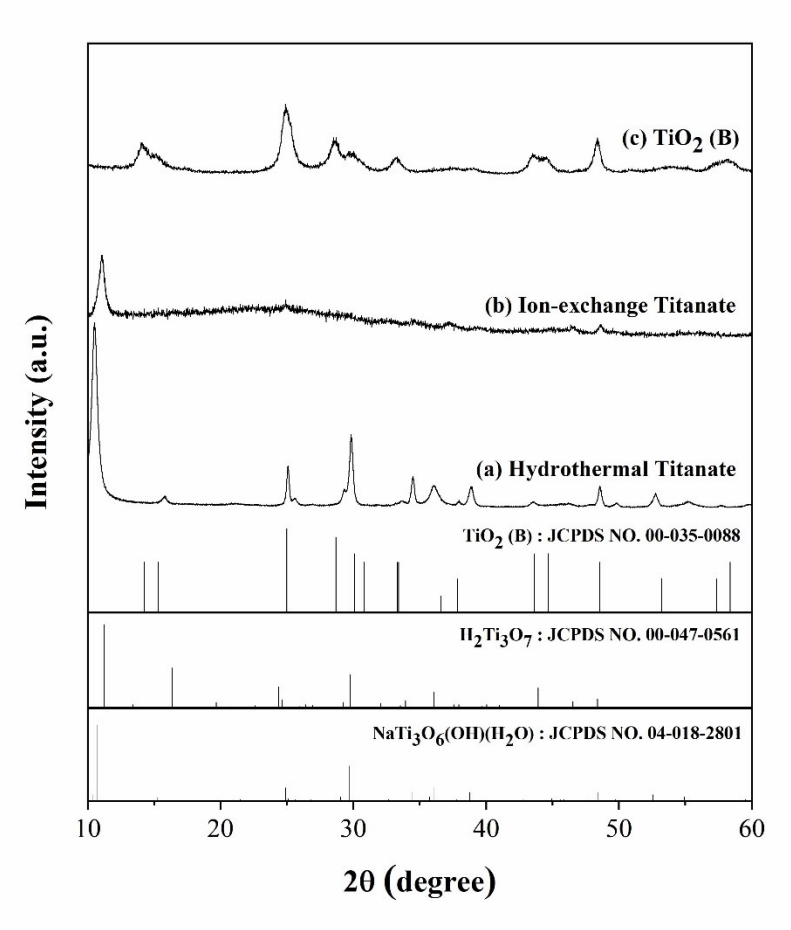

Fig. S5 the XRD patterns with reference lines for peak assignment: (a) $NaTi_3O_6(OH)(H_2O)$ after the hydrothermal reaction, (b) $H_2Ti_3O_7$ after ion-exchanging, and (c) TiO_2(B) after heat treatment.

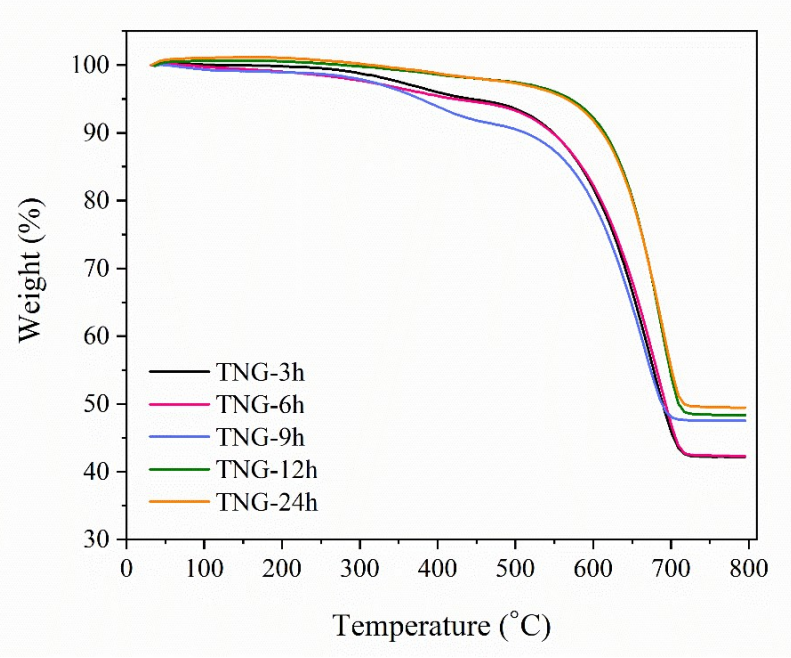

Fig. S6 Thermogravimetric analysis curves of as-prepared TNG products

Table S1. Discharge-charge capacities and coulombic efficiencies of TNG nanocomposite anodes at a current rate of 1C.

Sample	Phase and morphology	Cycle number	Discharge (mAh g^{-1})	Charge (mAh g^{-1})	Coulombic efficiency (%)
TNG-3h	Anatase nanoparticles on NG	1st cycle	474.01	391.66	82.63
		2nd cycle	403.94	374.43	92.69
		3rd cycle	385.63	364.23	94.45
TNG-6h	Anatase nanosheets on NG	1st cycle	347.19	288.49	83.09
		2nd cycle	300.03	280.34	93.44
		3rd cycle	289.26	274.09	94.76
TNG-9h	TiO_2(B) nanotubes on NG	1st cycle	430.13	361.20	83.97
		2nd cycle	375.98	354.43	94.27
		3rd cycle	381.38	364.83	95.66
TNG-12h	TiO_2(B) nanorods on NG	1st cycle	400.99	342.24	85.35
		2nd cycle	357.07	338.41	94.77
		3rd cycle	350.68	336.96	96.09
TNG-24h	TiO_2(B) nanorods on NG	1st cycle	634.54	527.42	83.12
		2nd cycle	550.14	507.79	92.30
		3rd cycle	525.57	494.07	94.01