Electronic Supplementary Information

Simple synthesis of graphene-doped flower-like cobalt–nickel–tungsten–boron oxides with self-oxidation for high-performance supercapacitors

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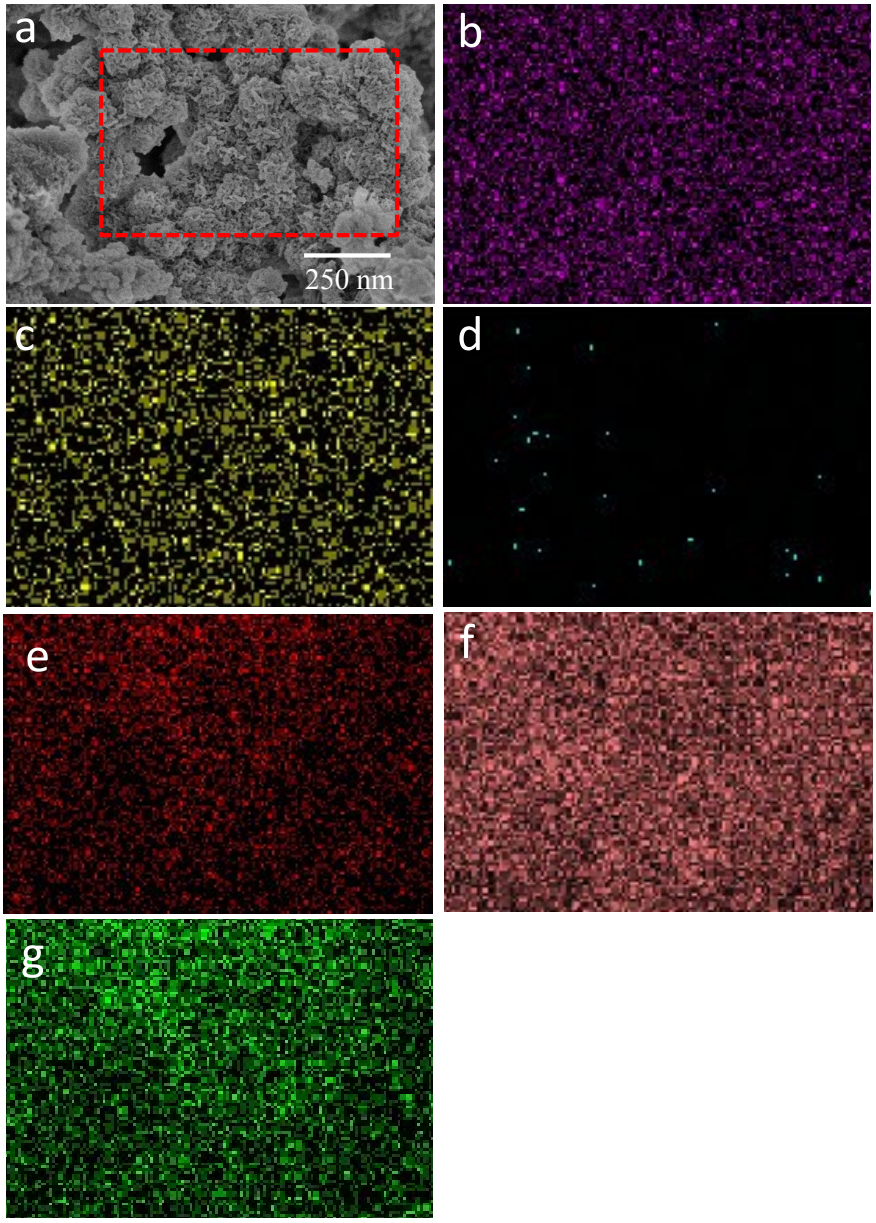

Fig. S1 SEM images of Co–Ni–W–O/rGO and EDX mapping images of (b) Co, (c) Ni, (d) W, (e) B, (f) O, and (g) C.

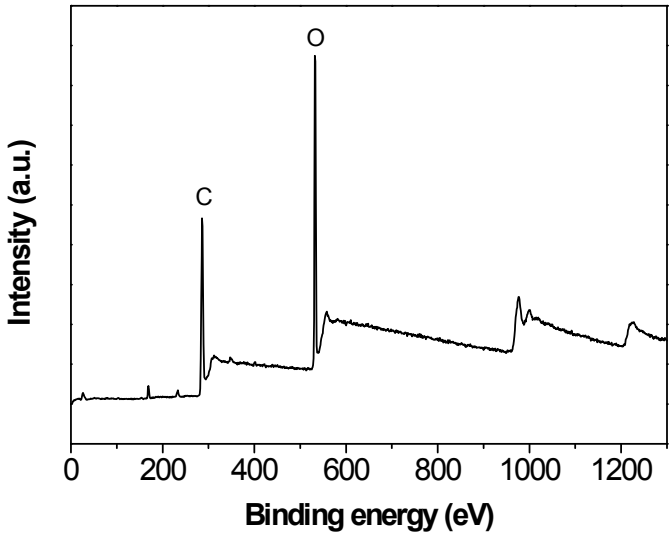

Fig. S2 Full XPS spectra of rGO.

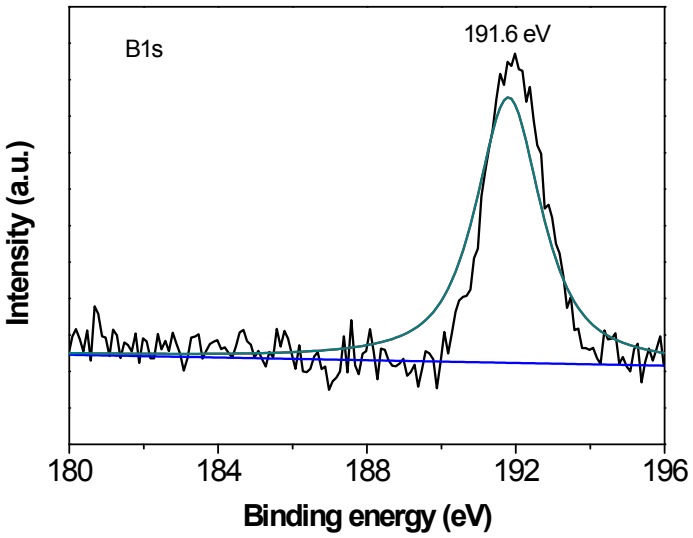

Fig. S3 XPS spectra of B1s.

Table S1 Specific capacitance calculated from CV curves of different materials, obtained at a scan rate of 10 mV s^{-1}

Sample	Specific capacitance (F g^{-1})
Co–B	491.3
Co–W–B	538.2
Co–Ni–B	638.1
Co–Ni–W–B	732.4
Co–Ni–W–B–O	796.7
Co–Ni–W–B–O/20 rGO	1059.2

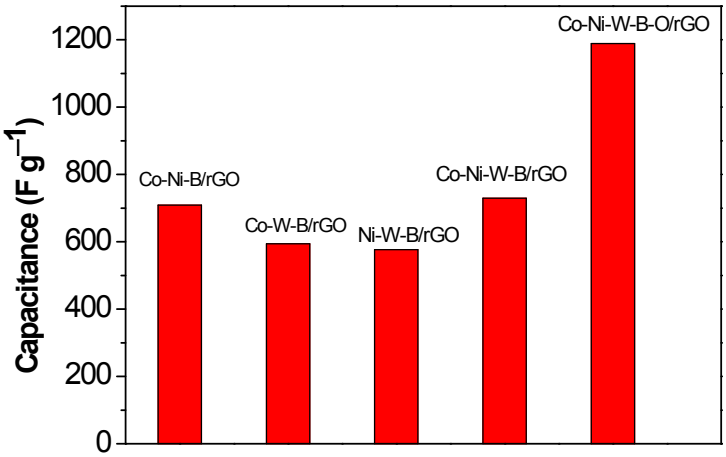

Fig S4 Capacitance of Co–Ni–B/rGO, Co–W–B/rGO, Ni–W–B/rGO, Co–Ni–W–B/rGO, and Co–Ni–W–B–O/rGO, obtained from their charge–discharge curves.

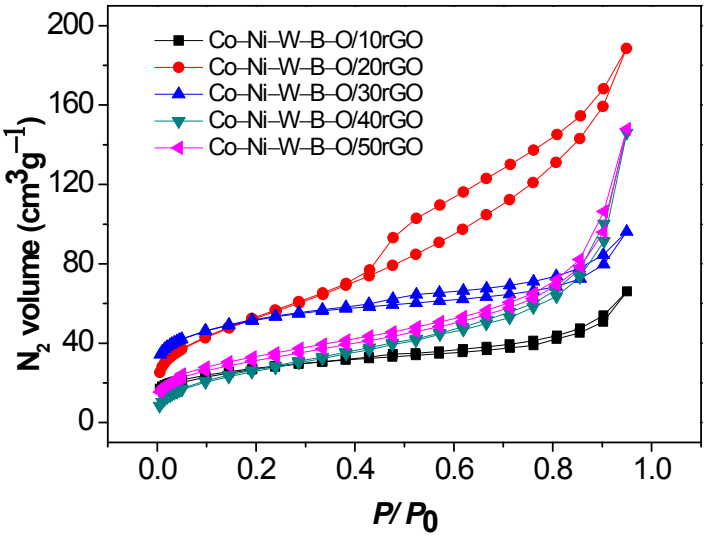

Fig. S5 Nitrogen adsorption isotherms of Co–Ni–W–B–O/rGO samples containing different amounts of rGO.

Table S2 Specific areas of Co–Ni–W–B–O/rGO samples containing different amounts of rGO.

Sample	Specific area (m^2 g^{-1})
Co–Ni–W–B–O/10rGO	120.4
Co–Ni–W–B–O/20rGO	167.5
Co–Ni–W–B–O/30rGO	153.2
Co–Ni–W–B–O/40rGO	128.9
Co–Ni–W–B–O/50rGO	120.6

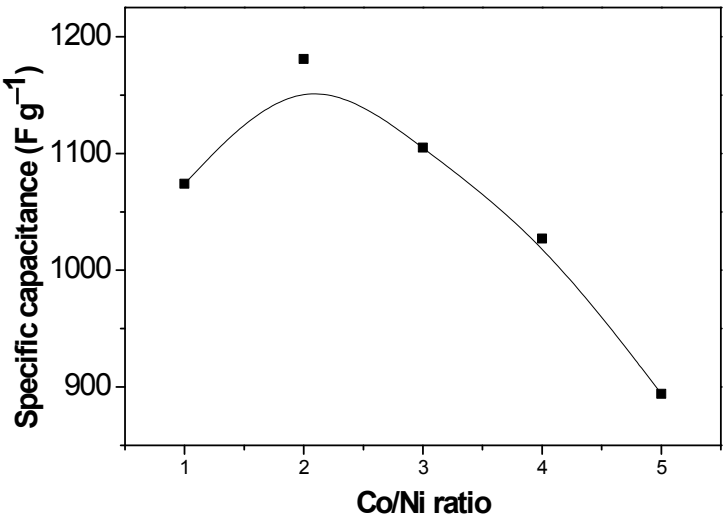

Fig. S6 Effect of Co/Ni molar ratio on the specific capacitance of the Co–Ni–W–B–O/20rGO electrode.

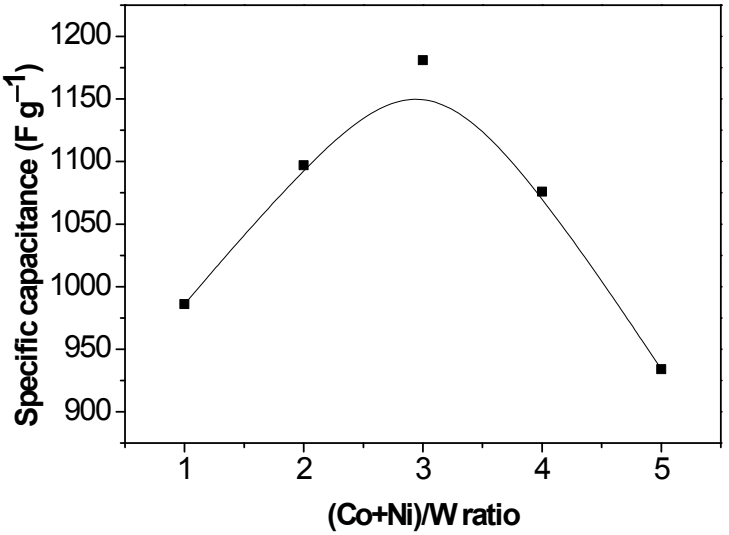

Fig. S7 Effect of (Co+Ni)/W molar ratio on the specific capacitance of the Co–Ni–W–B–O/20 rGO electrode.

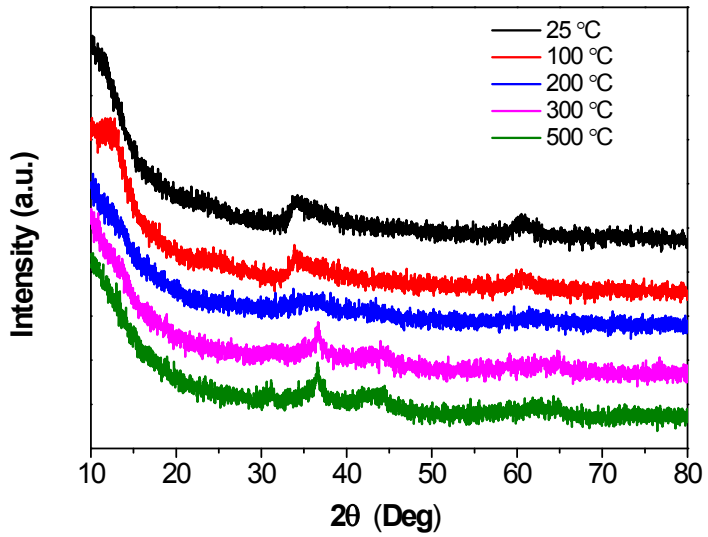

Fig. S8 XRD patterns of samples annealed in N_2 for 2 h at different temperatures.

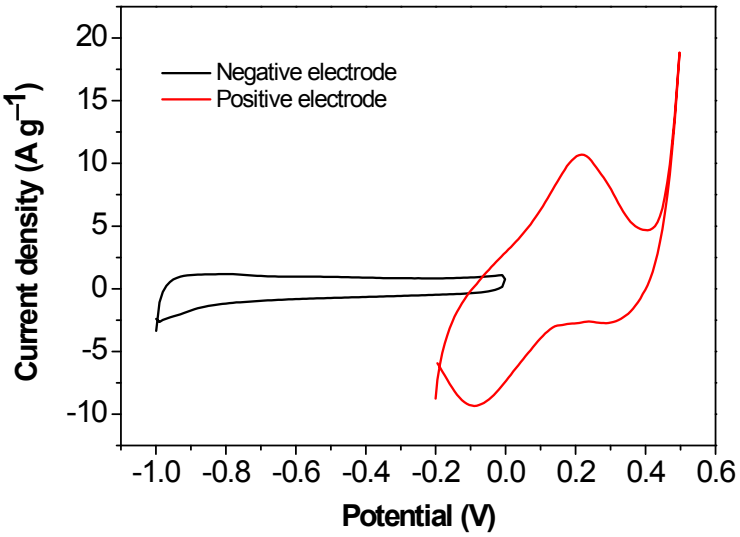

Fig. S9 CV curves of the negative electrode and positive electrode at the scan rate of 5 mV s^{-1}

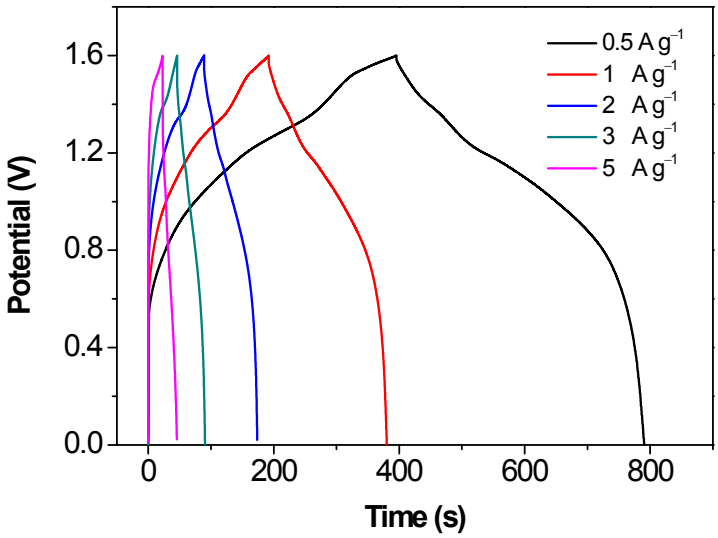

Fig. S10 Galvanostatic charge–discharge curves of the Co–Ni–W–B–O/20rGO//rGO asymmetric supercapacitor, measured at different current densities.

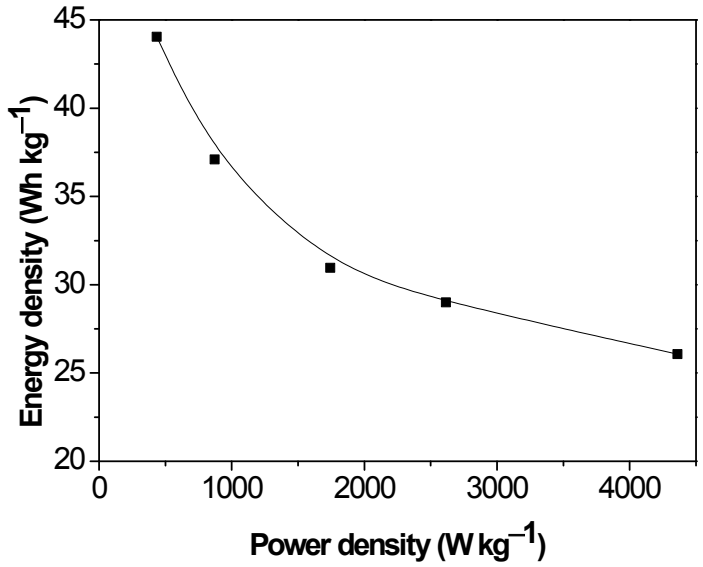

Fig. S11 Ragone plot related to the energy and power densities of Co–Ni–W–B–O/20rGO//rGO.

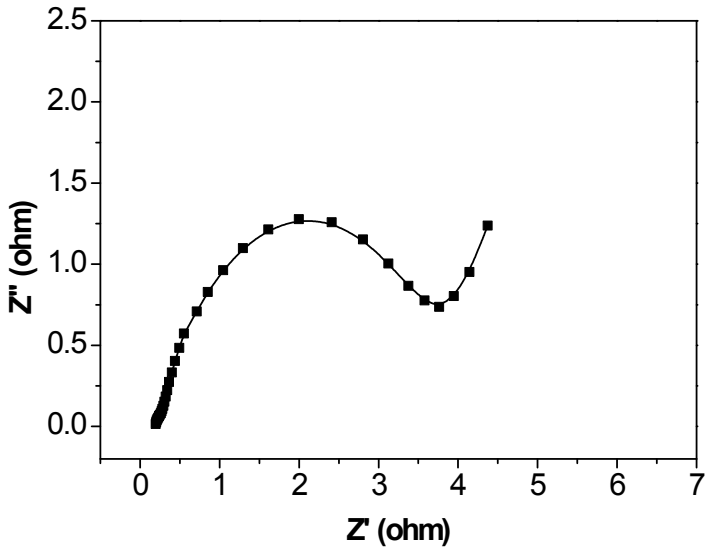

Fig. S12 Nyquist plot of the Co–Ni–W–B–O/20rGO//rGO asymmetric supercapacitor.

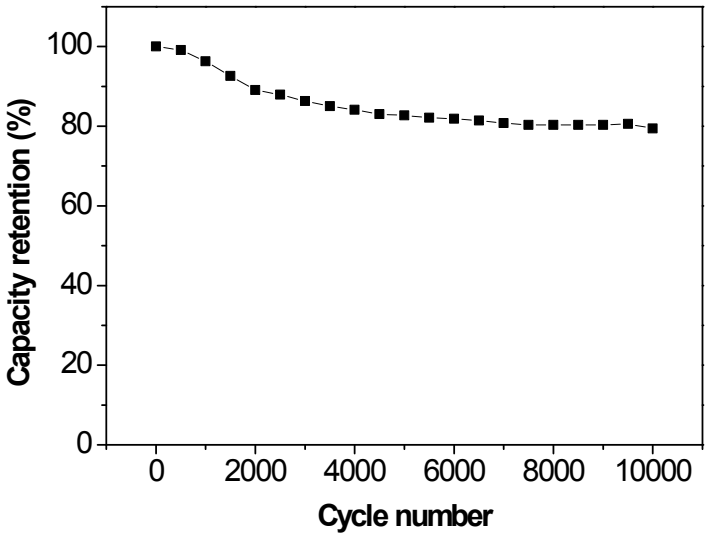

Fig. S13 Cycle stability of the Co–Ni–W–B–O/20rGO//rGO asymmetric supercapacitor at a current density of 5 A g^{-1} for 10000 cycles.