Supporting Information for

Synthesis and physicochemical properties of the graphene/ZrO_2 composite aerogels

Dongman Guo[1], Yun Lu[1,*], Yibo Zhao[2], Xuetong Zhang[1,3,*]

[1] School of Materials Science and Engineering, Beijing Institute of Technology, Beijing 100081, P. R. China. E-mail: luyun@bit.edu.cn; zhangxtchina@yahoo.com

[2] Aerospace Research Institute of Materials and Processing Technology, Beijing, 100076, P. R. China

[3] Suzhou Institute of Nano-Tech & Nano-Bionics, Chinese Academy of Sciences, Suzhou 215123, P. R. China

Figures

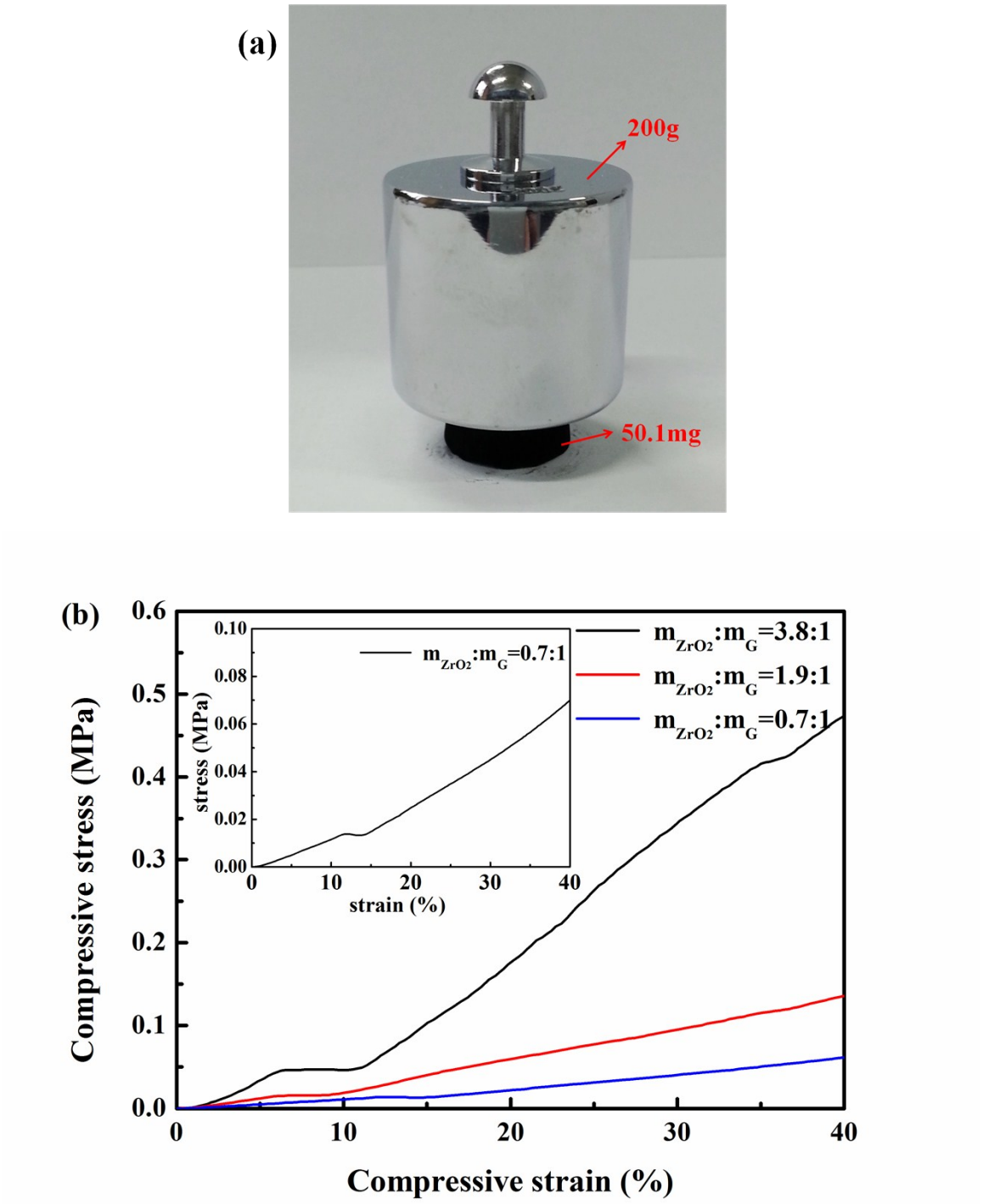


Figure SI1. (a) Digital photo showing a 200 g counterpoise being supported by a 50.1 mg graphene/ZrO_2 composite aerogel pillar, (b) compressive stress-strain curves of the graphene/ZrO_2 composite aerogels with the different mass ratios.

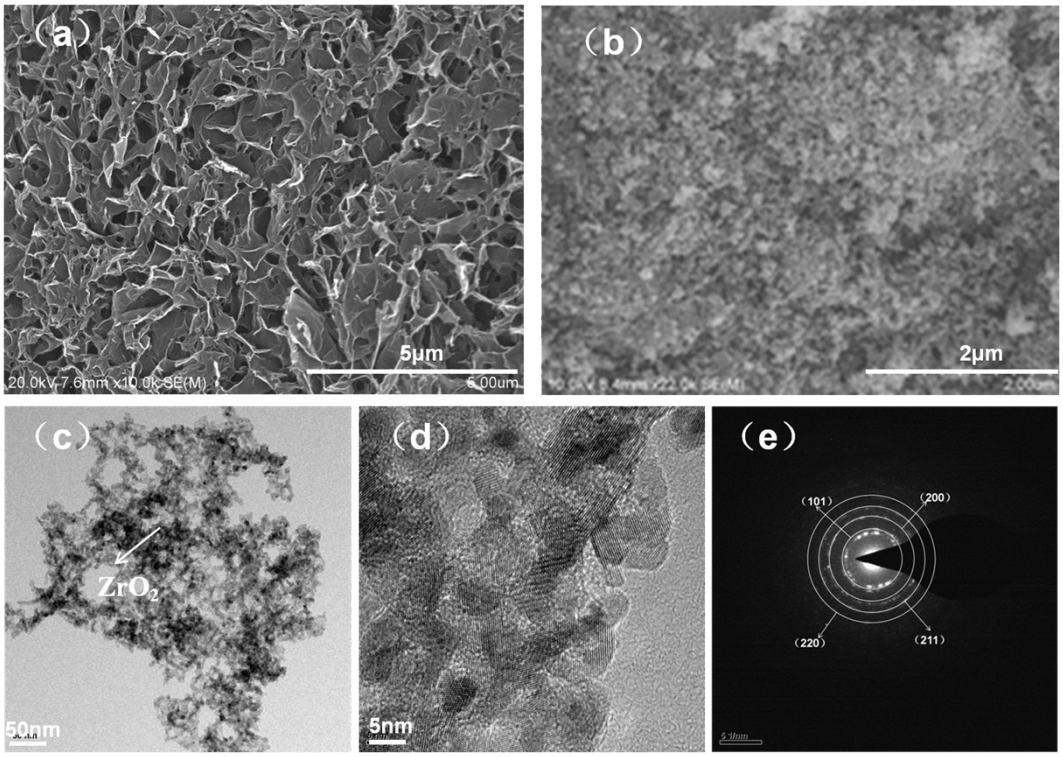


Figure SI2. SEM images of graphene aerogel (a) and ZrO_2 aerogel (b), TEM images of graphene/ZrO_2 composite aerogels (c, d), and selected area electron diffraction (SAED) pattern of the ZrO_2 aerogel (e).

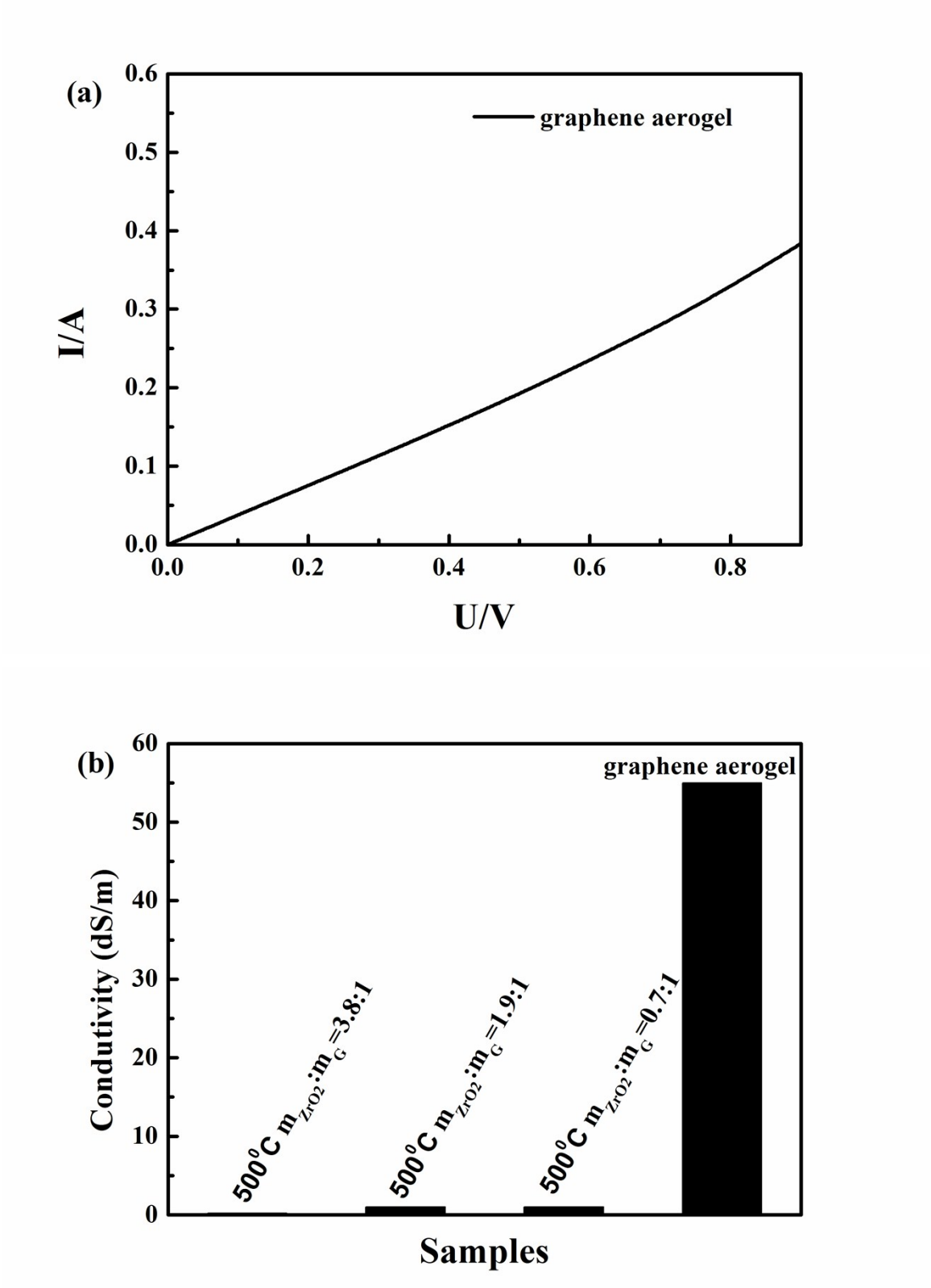
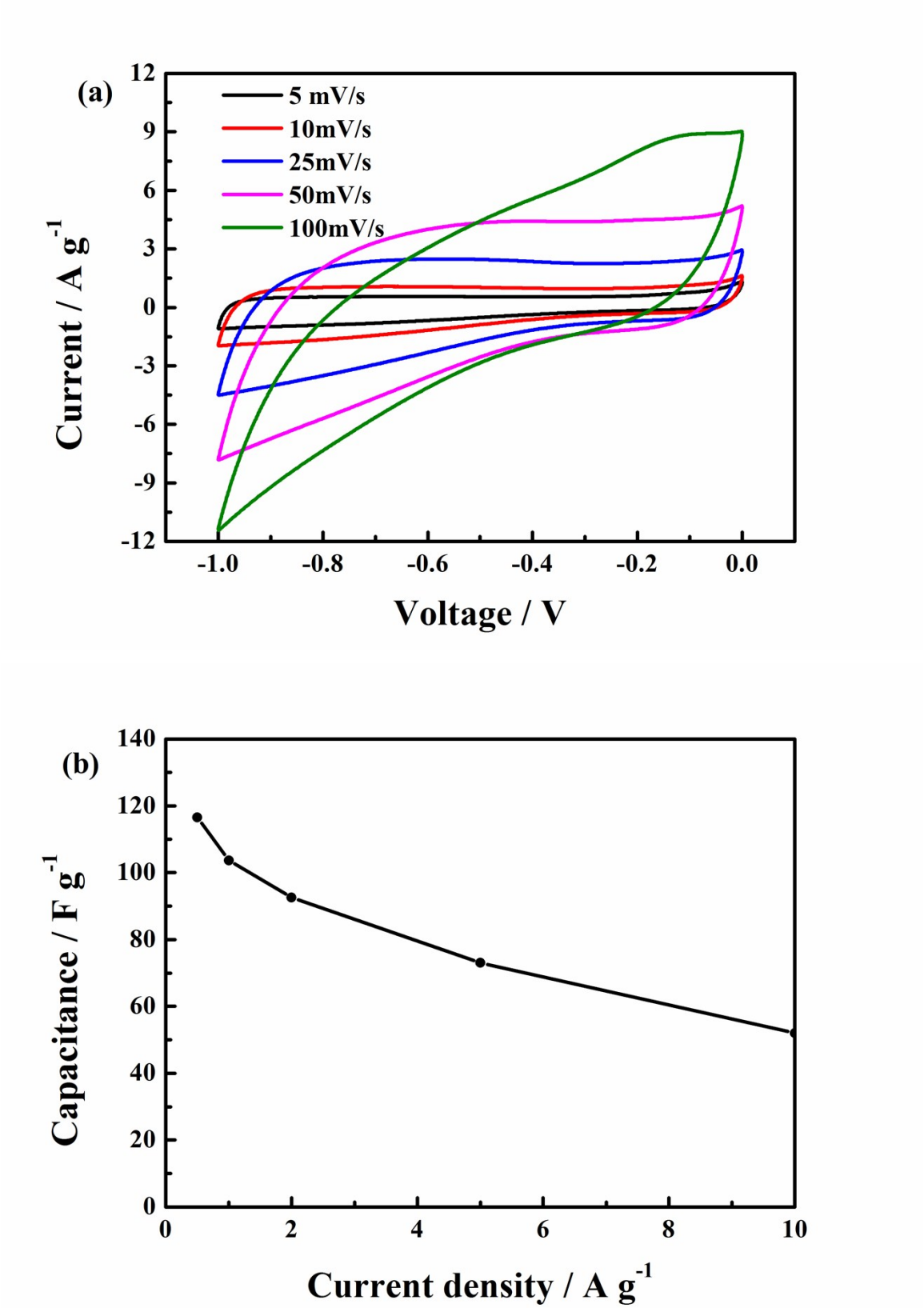


Figure SI3. *I–V* curve of the graphene aerogel (a) and conductivity comparison between graphene aerogel and their composites with ZrO_2 (b).


(a)
5 mV/s
10mV/s
25mV/s
50mV/s
100mV/s
Current / A g-1
Voltage / V
12
9
6
3
0
-3
-6
-9
-12
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
(b)
Capacitance / F g-1
Current density / A g-1
140
120
100
80
60
40
20
0
0
2
4
6
8
10

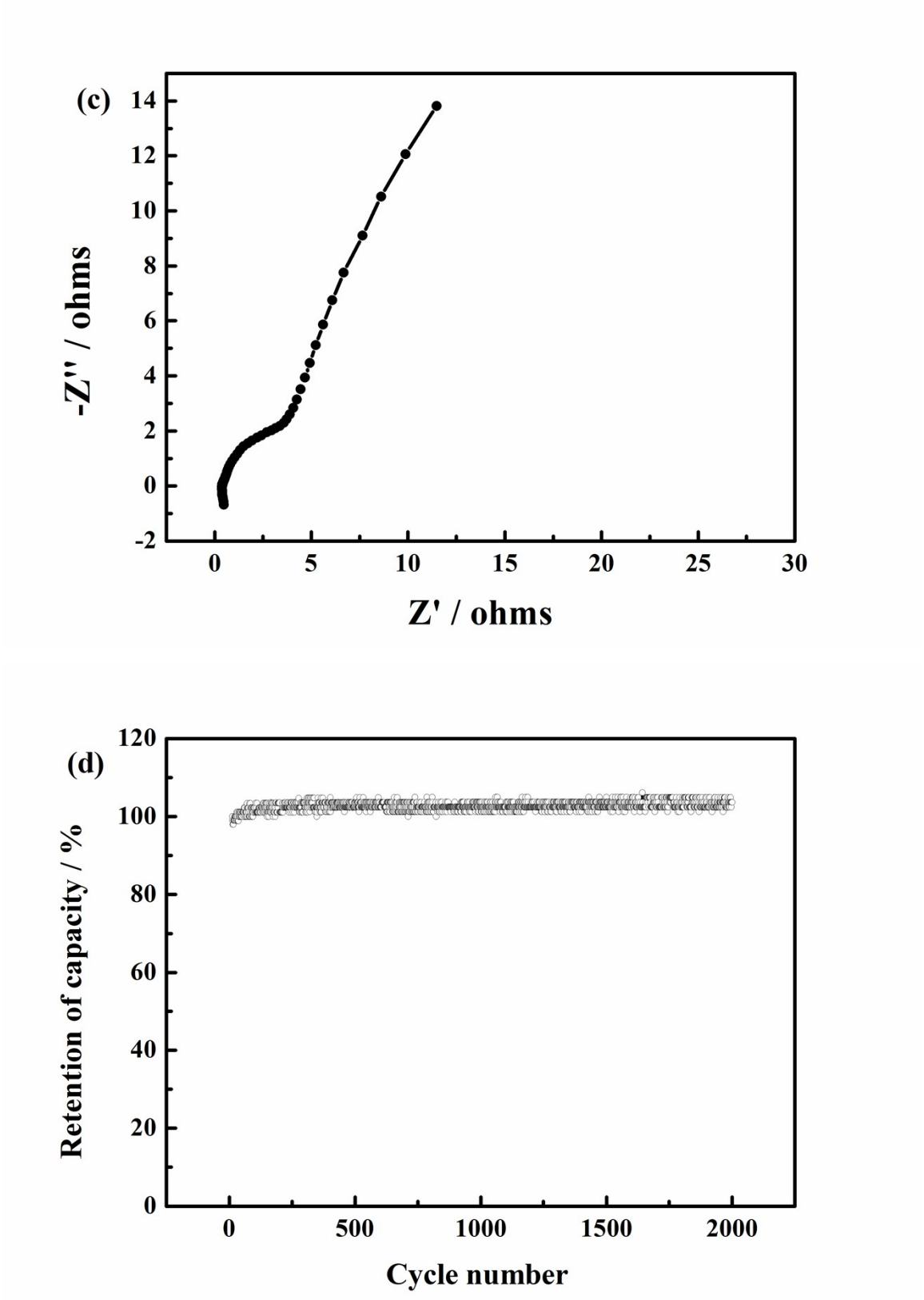
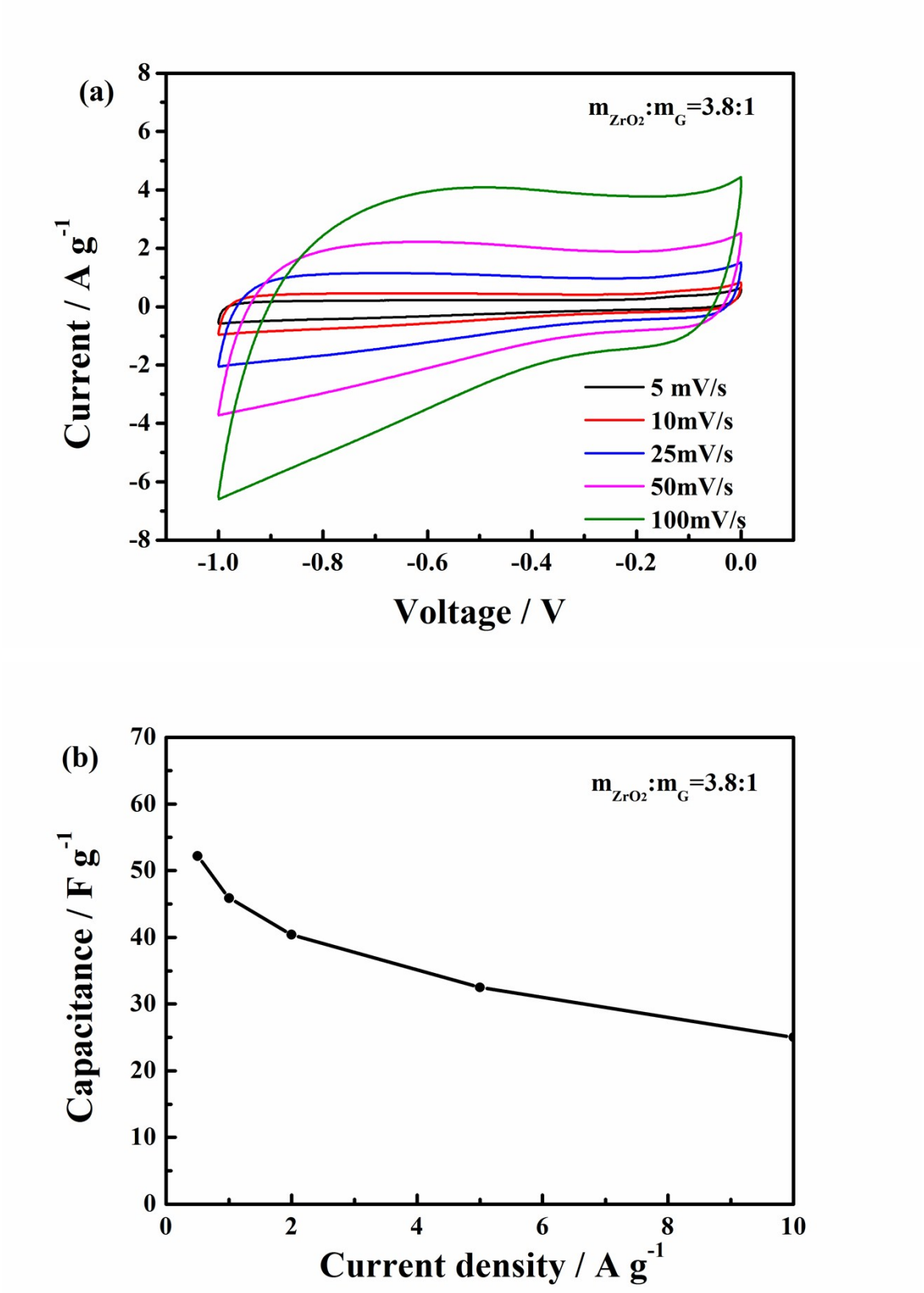


Figure SI4. Electrochemical investigation on the composite aerogels with the mass ratio of ZrO_2 to graphene at 0.7: (a) Cyclic voltammetry at different scan rates, (b) the dependence of the specific capacitance on the current density, (c) Nyquist plot, and (d) the cycle performance.


(a)
$m_{ZrO_2}:m_G$=3.8:1
Current / A g^{-1}
Voltage / V
5 mV/s
10mV/s
25mV/s
50mV/s
100mV/s
(b)
$m_{ZrO_2}:m_G$=3.8:1
Capacitance / F g^{-1}
Current density / A g^{-1}

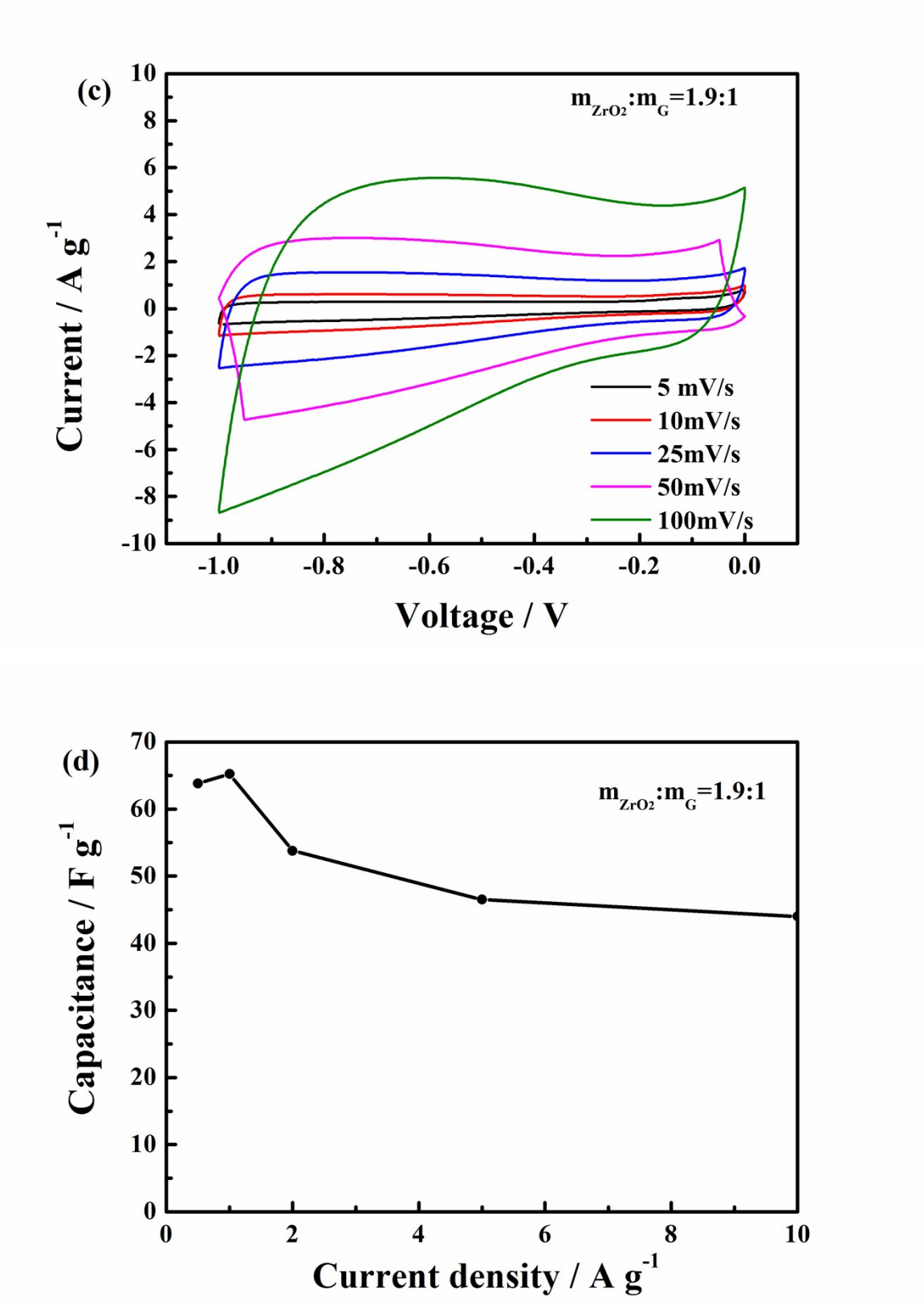


Figure SI5. (a), (c) Cyclic voltammetry curves of the graphene/ZrO_2 composite aerogels with the different mass ratios at different scan rates; (b), (d) the dependence of the specific capacitance of the graphene/ZrO_2 composite aerogels with the different mass ratios on the current density.

Tables

Table1 SI1 Mechanical properties of the graphene/ZrO_2 composite aerogels

Sample	Yield strength（MPa）	Young's modulus（MPa）
m_{ZrO2}:m_G=3.8:1	0.0455	1.16
m_{ZrO2}:m_G=1.9:1	0.0156	0.29
m_{ZrO2}:m_G=0.7:1	0.0138	0.12

Table1 SI2. The nitrogen sorption data of the graphene aerogel and graphene/ZrO_2 composite aerogels with different mass ratios of ZrO_2 to graphene.

Samples	Graphene Content (wt%)	Apparent Density (mg cm^{-3})	BET Surface Area (m^2g^{-1})	Porve Volume (cm^3 g^{-1})
m_{ZrO2}:m_G=3.8:1	20.8	70 ± 2	380	1.300
m_{ZrO2}:m_G=1.9:1	34.5	40 ± 2	490	1.450
m_{ZrO2}:m_G=0.7:1	58.8	20 ± 2	488	1.451
Graphene aerogel	100	200± 2	684	1.998

Table1 SI3. Thermal conductivity of the graphene aerogel and graphene/ZrO_2 composite aerogels with different mass ratios of ZrO_2 to graphene.

Samples	Test temperature (K)	Thermal conductivity (W m^{-1} K^{-1})
m_{ZrO2}:m_G=3.8:1	307.9	0.0259 ± 0.0002
m_{ZrO2}:m_G=1.9:1	308.2	0.0251 ± 0.0002
m_{ZrO2}:m_G=0.7:1	308.5	0.0249 ± 0.0002
Graphene aerogel	307.7	0.0485 ± 0.0002