Supplementary material

Bismuth Nanoparticles Encapsulated in a Porous Carbon Skeleton as Stable Chloride-Storage Electrodes for Seawater Desalination

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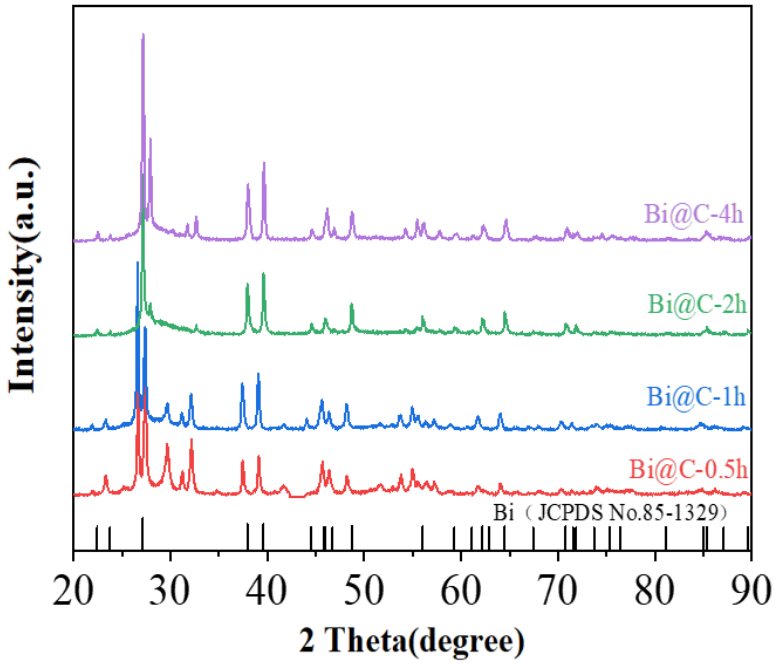

Figure S1. XRD pattern of materials at different annealing times

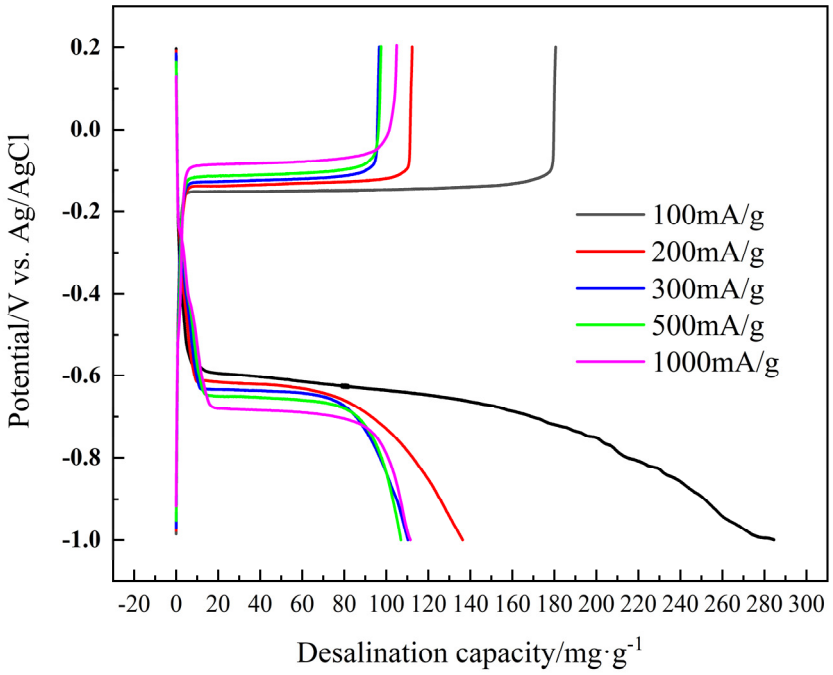

Figure S2. Charge and discharge curves at different current densities

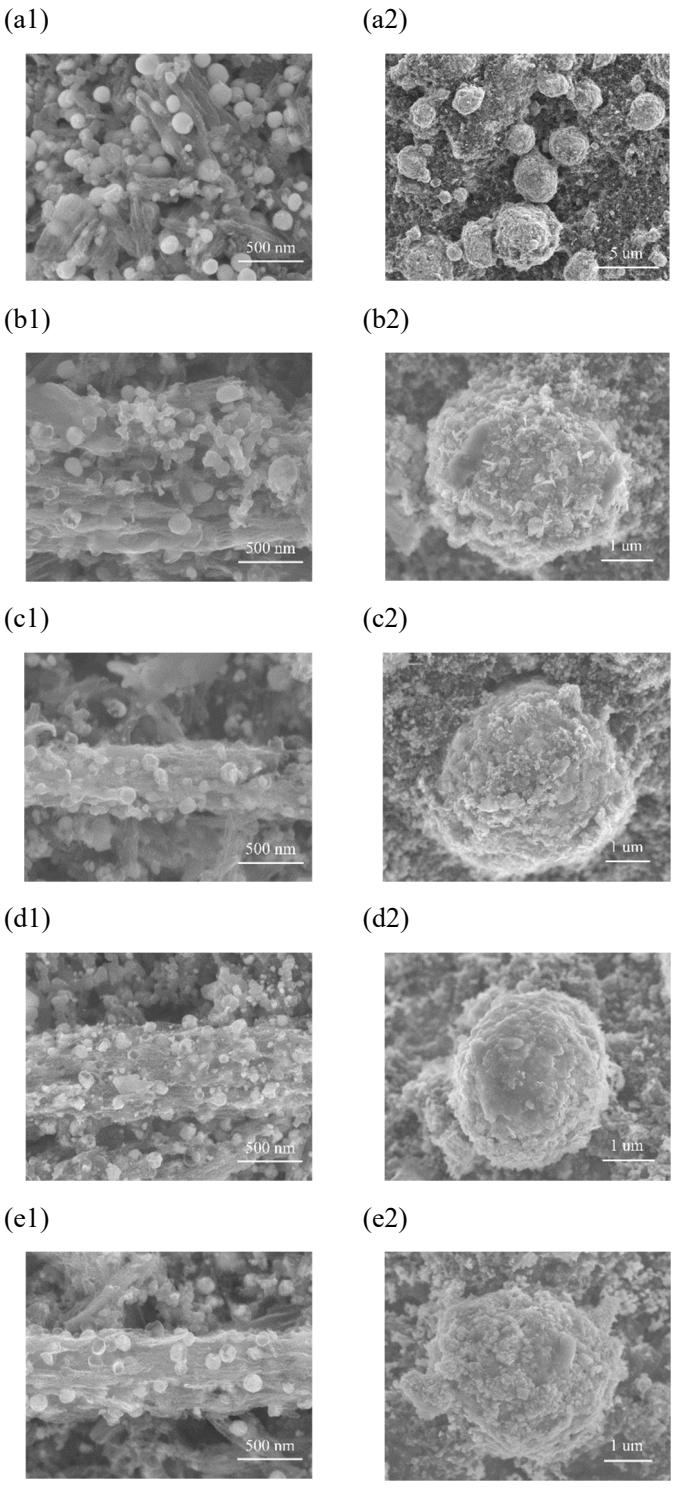

Figure S3. SEM image of demineralization process of Bi@C-2 h electrode and bare bismuth electrode

Bi@C-2 h electrode: (a1) before reaction; (b1) After the first storage of chlorine; (c1) After the first chlorination; (d1) After the fifth chlorination; (e1) After the 50th chlorination;

Bare bismuth electrode: (a2) before reaction; (b2) After the first storage of chlorine; (c2) after the first discharge of chlorine; (d2) After the fifth chlorination; (e2) After the 50th chlorination

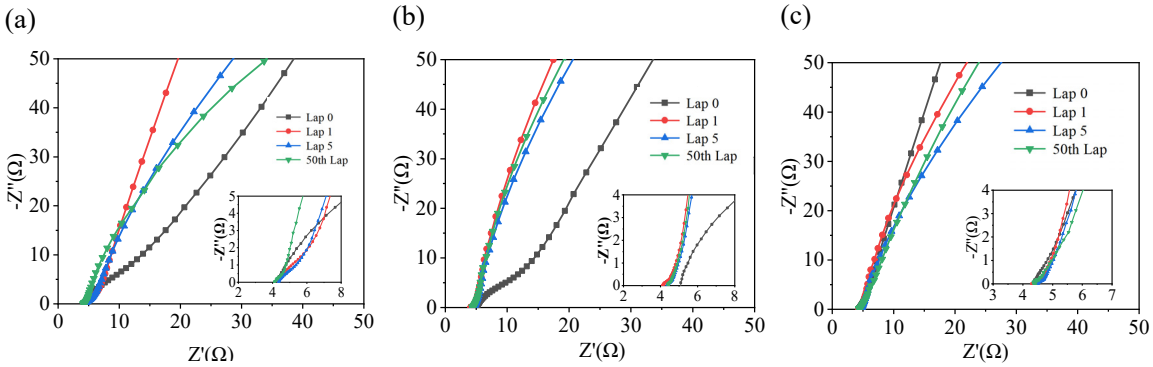

Figure S4. Impedance changes during the reaction of (a) bare bismuth electrode, (b) bismuth-carbon black electrode; (c) Bi@C electrode.

Table S1. Comparison of desalination capacity of Bi@C based DB with various carbon, pseudocapacitor and Faraday electrode materials reported in the literature.

Electrode Material	Cell	Power Mode	Desalination Voltage/Current	Mass (mg)	C_0 ($mg \cdot L^{-1}$)	SDC ($mg \cdot g^{-1}$)	Ref
Porous Carbon	CDI	C.V.	1.2 V/-	~50	50	2.2	[1]
		C.V.	1.2 V/-	~50	50	6.6	
Activate Carbon	MCDI	C.C.	1.2 V/2.0 mA	-	584.4	4.2	[2]
		C.C.	1.2 V/5.0 mA	-	584.4	6.8	
		C.C.	1.2 V/9.0 mA	-	584.4	10.0	
		C.C.	1.2 V/15.0 mA	-	584.4	15.7	
$Na_2FeP_2O_7$	HCDI	C.V.	1.2 V/-	-	584.4	30.2	[3]
		C.V.	1.2 V/-	-	5844.0	32.6	
		C.C.	1.2 V/3.0 mA cm^{-2}	-	584.4	7.8	
		C.C.	1.2 V/2.0 mA cm^{-2}	-	584.4	12.8	
		C.C.	1.2 V/1.5 mA cm^{-2}	-	584.4	16.9	
		C.C.	1.2 V/1.0 mA cm^{-2}	-	584.4	24.0	
		C.C.	1.2 V/3.0 mA cm^{-2}	-	5844.0	20.6	
		C.C.	1.2 V/2.0 mA cm^{-2}	-	5844.0	26.2	
		C.C.	1.2 V/1.5 mA cm^{-2}	-	5844.0	29.0	
		C.C.	1.2 V/1.0 mA cm^{-2}	-	5844.0	34.0	
$Na_3V_2(PO_4)_3$@C	HCDI	C.V.	1.0 V/-	10-20	5844.0	137.2	[4]

PNDIE	HCDI	C.V.	1.8 V/-	200/100*	1000.0	54.20	[5]
$NaTi_2(PO_4)_3$@C	HCDI	C.C.	2.0 V/500 mA	15 mg/cm^2	35064.0	146.8	[6]
Nafion-coated AC	RCDI	C.C.	1.2 V/1.0 mA cm^{-2}	55.9	584.4	23.30	[7]
		C.C.	1.2 V/1.25 mA cm^{-2}		584.4	29.90	
		C.C.	1.2 V/1.5 mA cm^{-2}		584.4	35.00	
		C.C.	1.2 V/1.0 mA cm^{-2}		1168.8	19.10	
		C.C.	1.2 V/1.25 mA cm^{-2}		1168.8	25.90	
		C.C.	1.2 V/1.5 mA cm^{-2}		1168.8	30.40	
		C.C.	1.2 V/2.0 mA cm^{-2}		1168.8	35.60	
		C.C.	1.2 V/1.0 mA cm^{-2}		2922.0	17.50	
		C.C.	1.2 V/1.25 mA cm^{-2}		2922.0	29.10	
		C.C.	1.2 V/1.5 mA cm^{-2}		2922.0	36.70	
		C.C.	1.2 V/2.0 mA cm^{-2}		2922.0	41.10	
		C.C.	1.2 V/3.0 mA cm^{-2}		2922.0	44.50	
BiOCl || $Na_{0.44}MnO_2$	DEDI	C.C.	1.5 V /100 mA g^{-1}	10.5/21.6*	760.0	68.50	[8]
		C.C.	1.5 V /200 mA g^{-1}		760.0	37.5	
		C.C.	1.5 V /300 mA g^{-1}		760.0	22.40	
		C.C.	1.5 V /500 mA g^{-1}		760.0	9.20	
$NaTi_2(PO_4)_3$ || AgNPs	DEDI	C.C.	1.4 V /100 mA g^{-1}	10-20	2500.0	105.00	[9]
		C.C.	1.4 V /200 mA g^{-1}		2500.0	77.00	
		C.C.	1.4 V /300 mA g^{-1}		2500.0	50.00	
		C.C.	1.4 V /500 mA g^{-1}		2500.0	26.00	
		C.C.	1.4 V /1000 mA g^{-1}		2500.0	15.00	
$Na_3V_2(PO_4)_3$@C || AgCl	DEDI	C.C.	1.4 V /100 mA g^{-1}	10	1000.0	98.00	[10]
		C.C.	1.4 V /500 mA g^{-1}		1000.0	34.0	
Bi@C (This work)	BD	C.C.	0.2 V /100 mA g^{-1}	10	35100.0	178.0	
		C.C.	0.2 V /200 mA g^{-1}		35100.0	145.7	
		C.C.	0.2 V /300 mA g^{-1}		35100.0	96.0	
		C.C.	0.2 V /500 mA g^{-1}		35100.0	108.4	
		C.C.	0.2 V /1000 mA g^{-1}		35100.0	119.3	

Reference

1. M. Wang, X. T. Xu, Y. Liu, Y. J. Li, T. Lu and L. K. Pan, *Carbon*, 2016, **108**, 433-439.
2. T. Kim and J. Yoon, *RSC Adv.*, 2015, **5**, 1456-1461.
3. S. Kim, J. Lee, C. Kim and J. Yoon, *Electrochim. Acta*, 2016, **203**, 265-271.
4. J. Cao, Y. Wang, L. Wang, F. Yu and J. Ma, *Nano Lett.*, 2019, **19**, 823-828.
5. Y. Li, Z. Ding, J. Li, J. Li, T. Lu and L. Pan, *Desalination*, 2019, **469**, 114098.
6. Z. Guo, Y. Ma, X. Dong, M. Hou, Y. Wang and Y. Xia, *ChemSusChem*, 2018, **11**, 1741-1745.
7. J. Lee, K. Jo, J. Lee, S. P. Hong, S. Kim and J. Yoon, *ACS. Sustain. Chem. Eng.*, 2018, **6**, 10815-10822.
8. F. Chen, Y. Huang, L. Guo, L. Sun, Y. Wang and H. Y. Yang, *Energ. Environ. Sci.*, 2017, **10**, 2081-2089.
9. Y. Huang, F. Chen, L. Guo, J. Zhang, T. Chen and H. Y. Yang, *Desalination*, 2018, **451**, 241-247.
10. W. Zhao, L. Guo, M. Ding, Y. Huang and H. Y. Yang, *ACS Appl. Mater. Inter.*, 2018, **10**, 40540-40548.