Supporting Information

Regenerable Nickel-functionalized Activated Carbon Cathodes Enhanced by Metal Adsorption to Improve Hydrogen Production in Microbial Electrolysis Cells

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Number of Pages: 9

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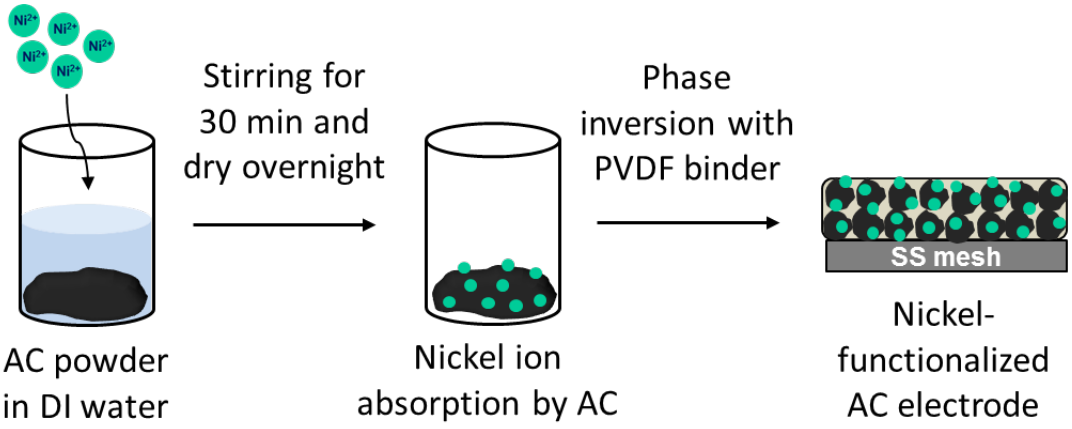

Figure S1. Illustration of procedures to fabricate AC-Ni electrodes.

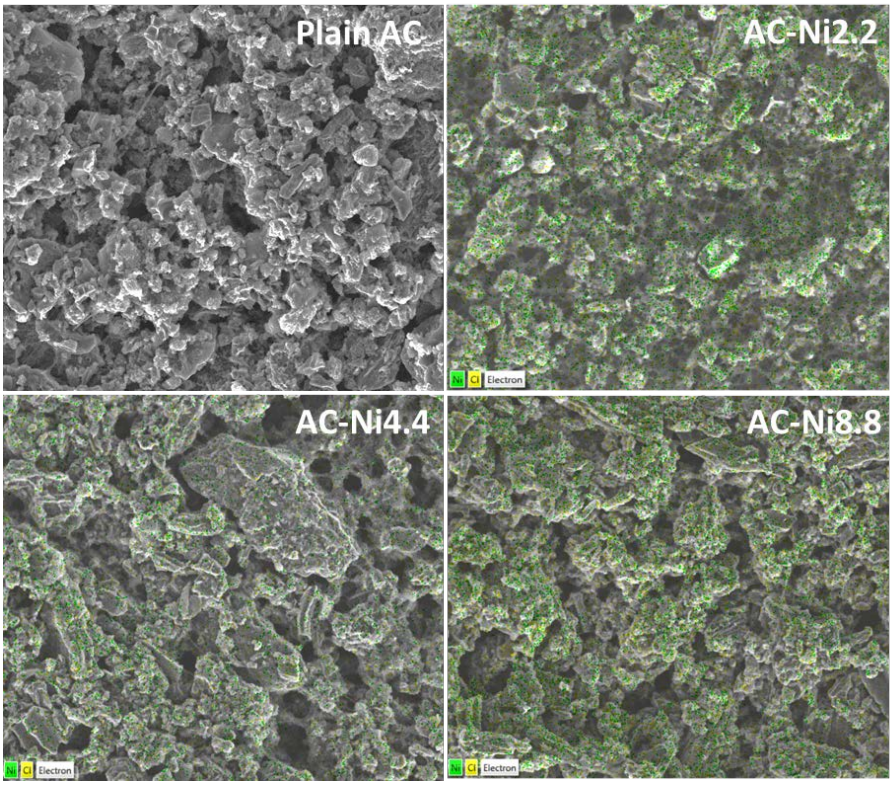

Figure S2. EDS images using AC-Ni2.2, AC-Ni4.4, AC-Ni8.8, and plain AC. The colors indicate nickel (green) and chloride (yellow).

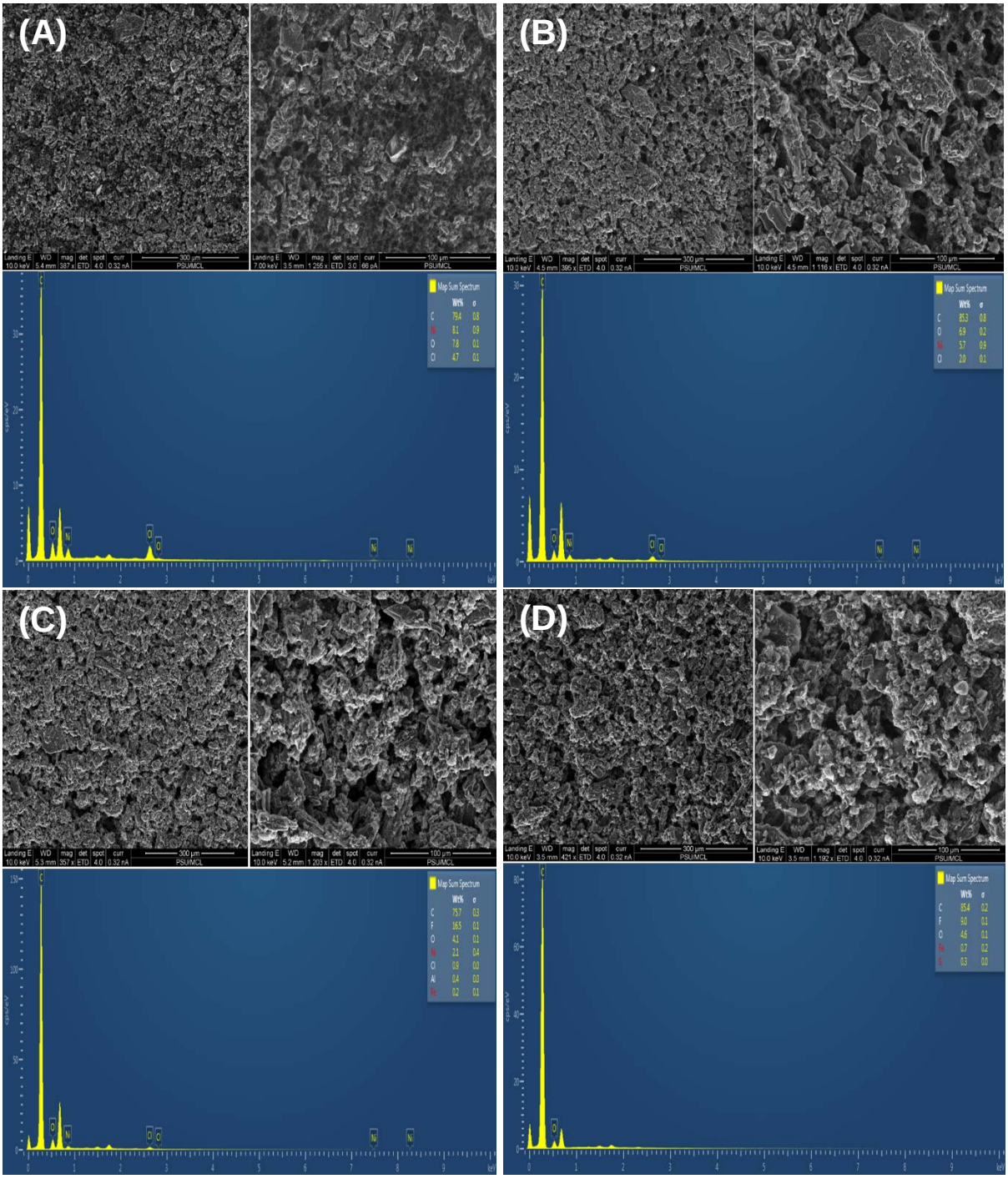

Figure S3. SEM images and EDS spectrums of (A) AC-Ni2.2, (B) AC-Ni4.4, (C) AC-Ni8.8 and (D) plain AC electrodes.

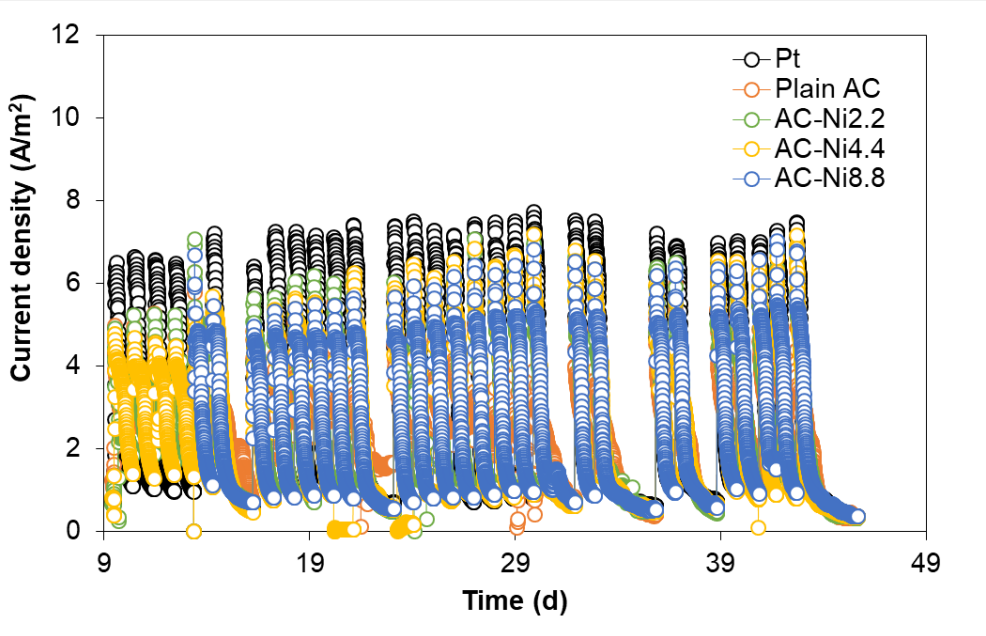

Figure S4. Current generations of cubic MECs with AC-Ni, plain AC and Pt cathodes over 30 days. Data was not shown for acclimation period (before day 9).

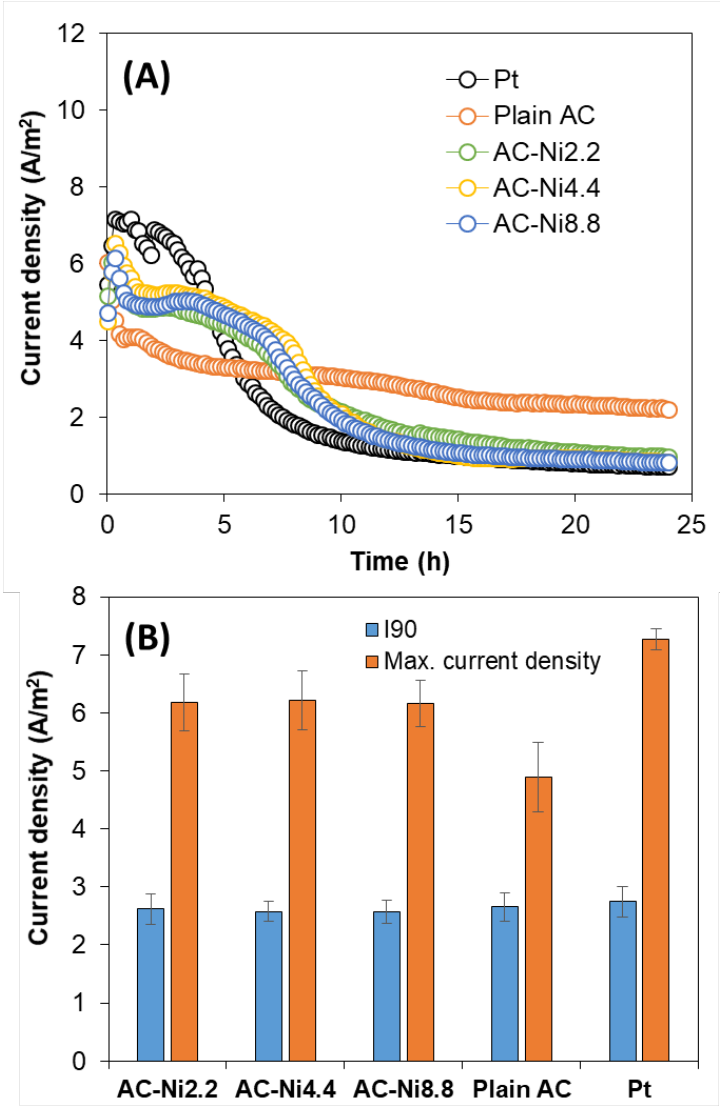

Figure S5. (A) Current generations of cubic MECs with AC-Ni, plain AC and Pt cathodes for a single cycle (from day 26), (B) Comparison of maximum and I_{90} current densities. Error bars indicate standard deviation (n≥15).

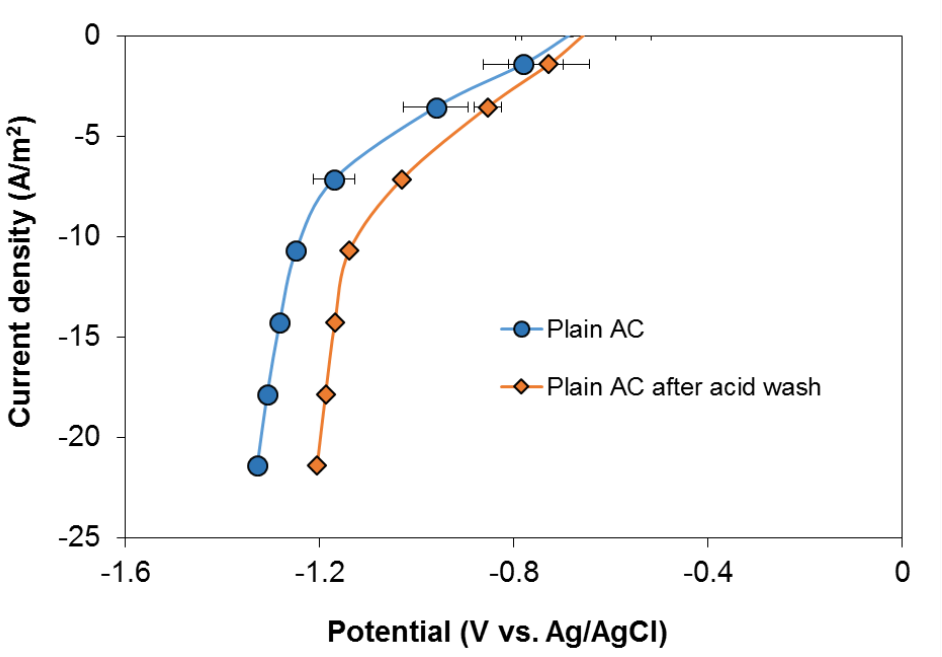

Figure S6. Chronopotentiometry (CP) test results for plain AC and acid-washed plain AC electrode. Error bars indicate standard deviation (n=3).

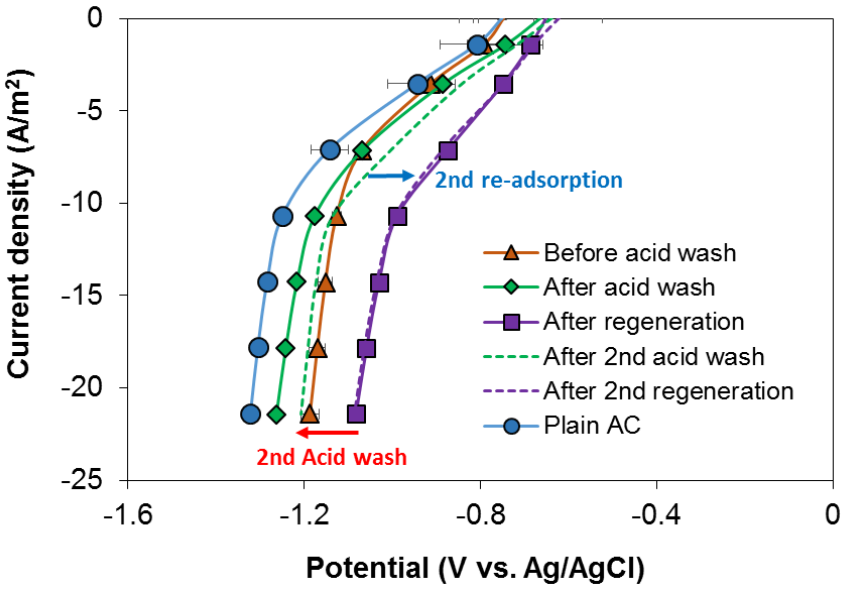

Figure S7. Repeated regeneration test results for AC-Ni cathodes. Dashed lines indicate results after a 2nd (repeated) acid wash and regeneration tests. Error bars indicate standard deviation (n≥2).

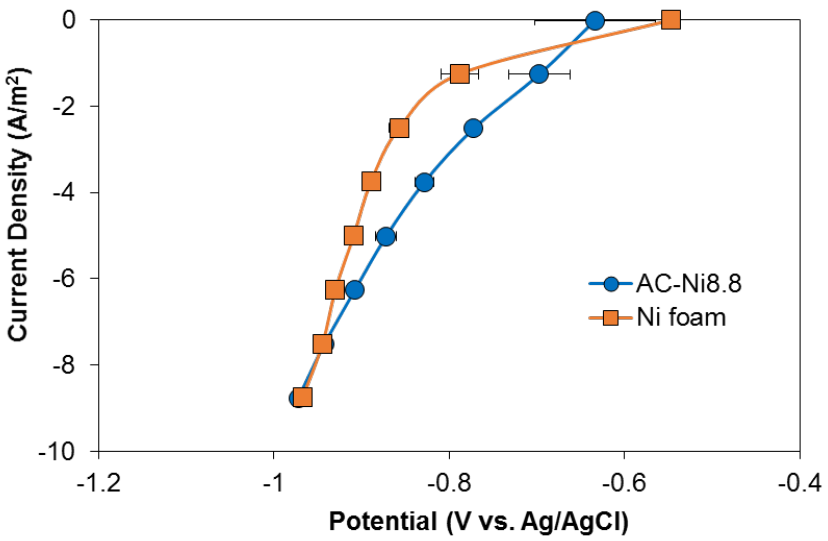

Figure S8. Chronopotentiometry (CP) test results for the AC-Ni8.8 and Ni foam with catholyte recirculation. Error bars indicate standard deviation (n=3).

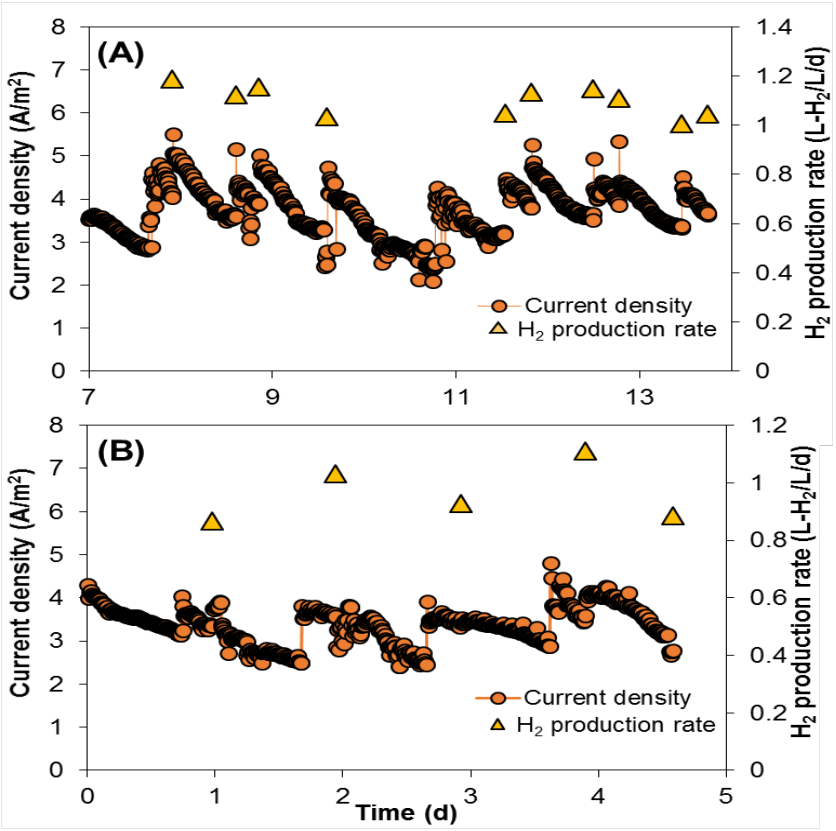

Figure S9. Continuous current generation and hydrogen production rates of MECs with (A) AC-Ni8.8 cathode and (B) Ni foam in a larger scale MEC (total volume: 168 mL) with catholyte recirculation.

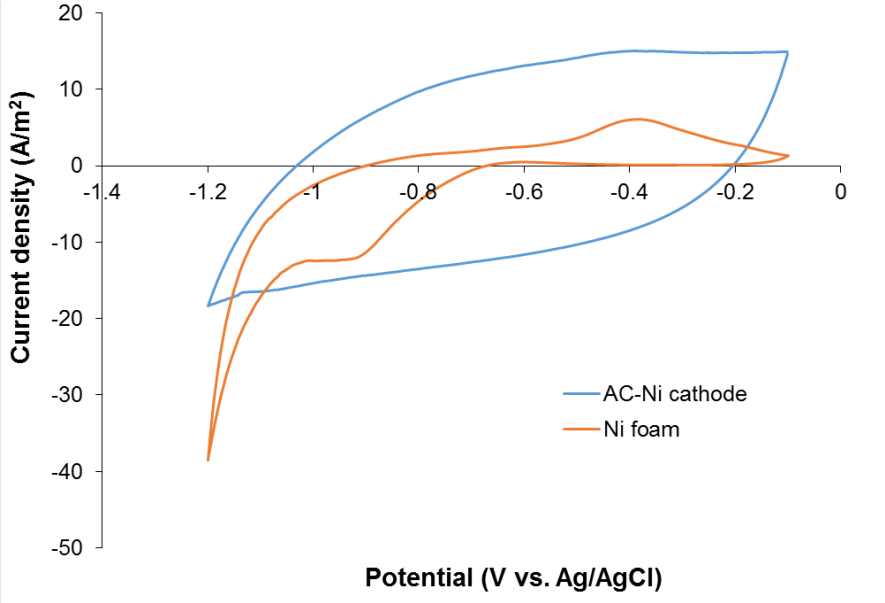

Figure S10. Cyclic voltammetry (CV) results for AC-Ni4.4 cathode (blue) and Ni foam (orange). Voltage was swept from –1.2 V to –0.1 V (vs. Ag/AgCl) at scan rate of 1 mV/sec.

Table S1. Estimated price of AC-Ni and Pt/C electrodes for the MECs and commercialized price of Ni foam.

	Catalyst			Binder		Current collector		
	Activated carbon ($/m^2)	$NiCl_2 \cdot 6H_2O$ ($/m^2)	Pt/C powder ($/m^2)	PVDF ($/m^2)	Nafion binder ($/m^2)	Nickel foam ($/m^2)	SS mesh ($/m^2)	Total price ($/m^2)
AC-Ni	0.4	4.4	n.a.	1	n.a.	n.a.	12	18
Nickel foam	n.a.	n.a.	n.a.	n.a.	n.a.	20	n.a.	20
Pt/C	n.a.	n.a.	1630	n.a.	210	n.a.	12	1852

*n.a: Not available

**All price sources can be found at http://www.alibaba.com

Table S2. Final catholyte pHs of cubic MECs with AC-Ni, plain AC and Pt cathodes after 24 h cycle and the time periods (h) that required for 90% of the coulombs to be generated (I_{90} time). Standard deviations indicate n≥15 for final catholyte pHs and n=5 for I_{90} time.

	AC-Ni2.2	AC-Ni4.4	AC-Ni8.8	Plain AC	Pt
Final catholyte pH	9.8±0.3	10.1±0.3	10.5±0.2	8.4±0.1	10.2±0.3
I_{90} time (h)	18.2±0.3	16.8±0.6	17.3±0.5	20.2±0.7	16.7±0.5