Supplementary materials

A Cellulose Electrolysis Cell with Metal-Free Carbon Electrodes

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The Supporting Information includes methods and additional figures and tables.

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Supporting Figures

Figure S1. Electrolysis characteristics of cells using KB, AB, and Vulcan cathodes at 150 °C: (a) *I-V* curves and (b) impedance spectra. The blank test was conducted without the carbon catalyst at the cathode.

Figure S2. SEM micrographs of (a) MH, (b) MJ10, (c) MJ30, and (d) MJ150.

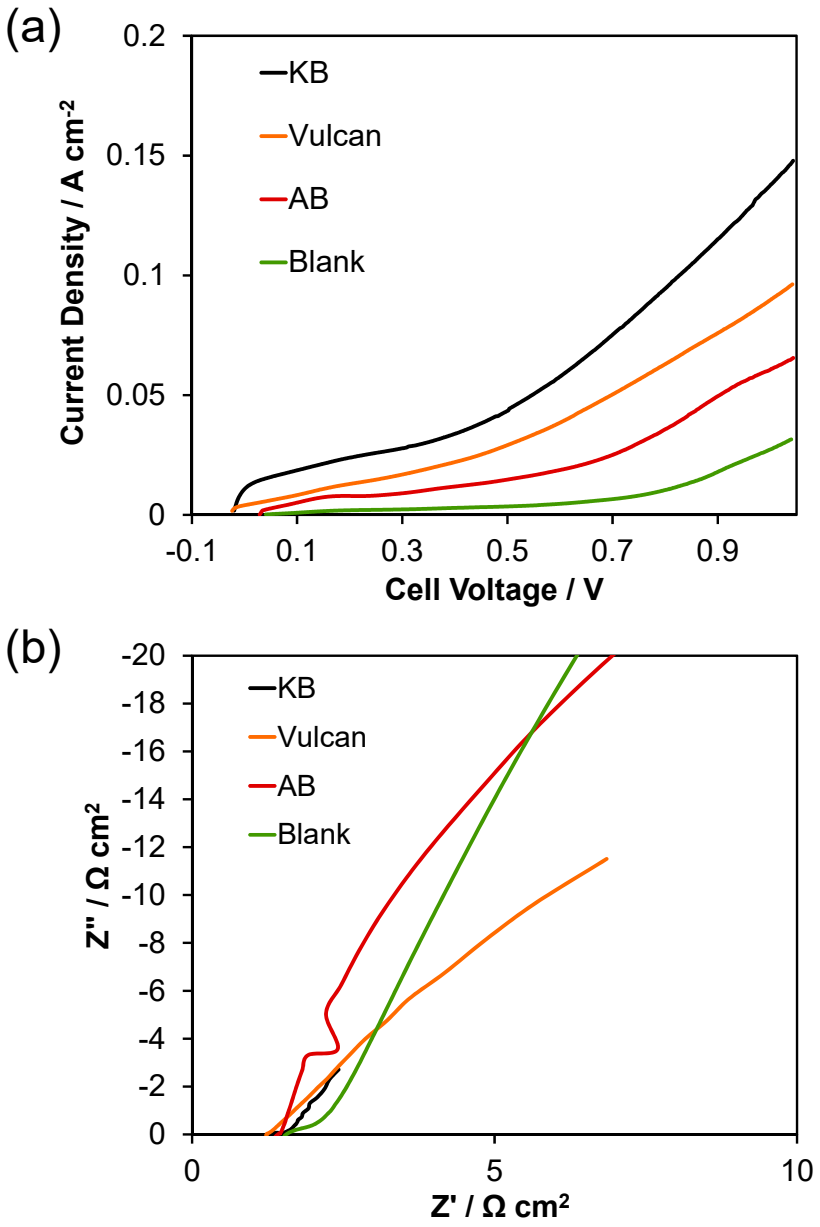
Figure S3. Impedance spectra of cells using KB, MH, MJ10, MJ30, and MJ150 cathodes at 150 °C. Black dotted lines represent curve-fitting results.

Figure S4. Raman spectra of KB, MH, MJ10, MJ30, and MJ150.

Supporting Tables

Table S1. Textural properties of AB, Vulcan, and KB.

Table S2. Fitted values for R_{bulk}, R_1, and W of cells using the MH, MJ10, MJ30, and MJ150 cathodes.



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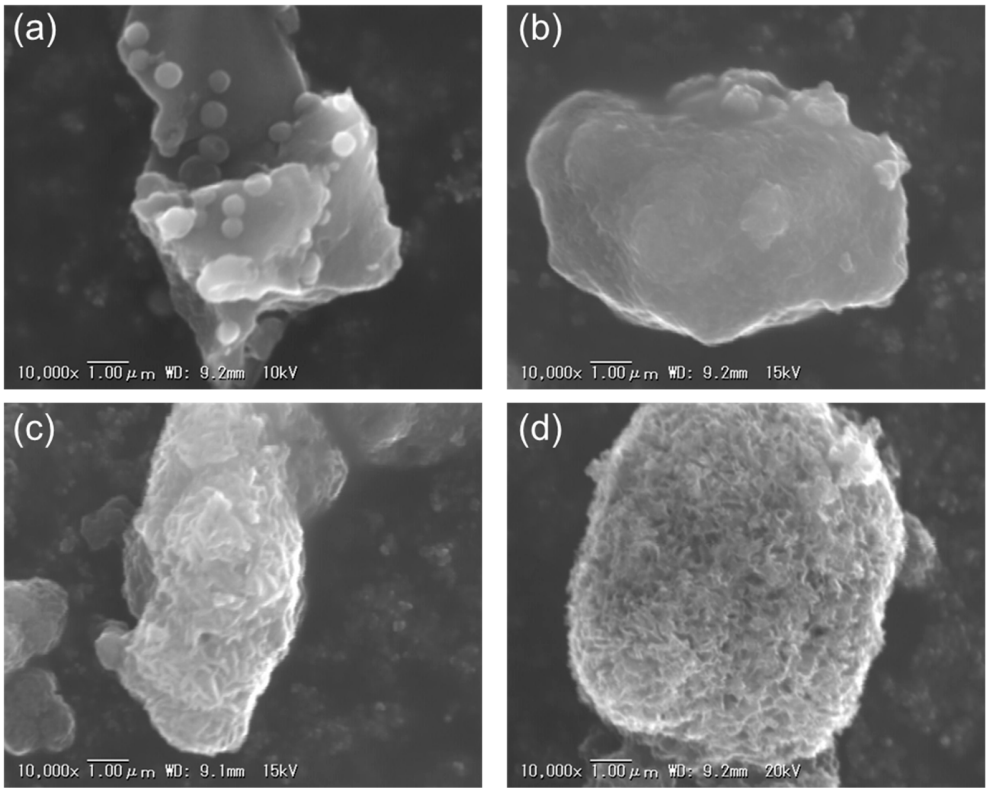

Figure S2. SEM micrographs of (a) MH, (b) MJ10, (c) MJ30, and (d) MJ150.

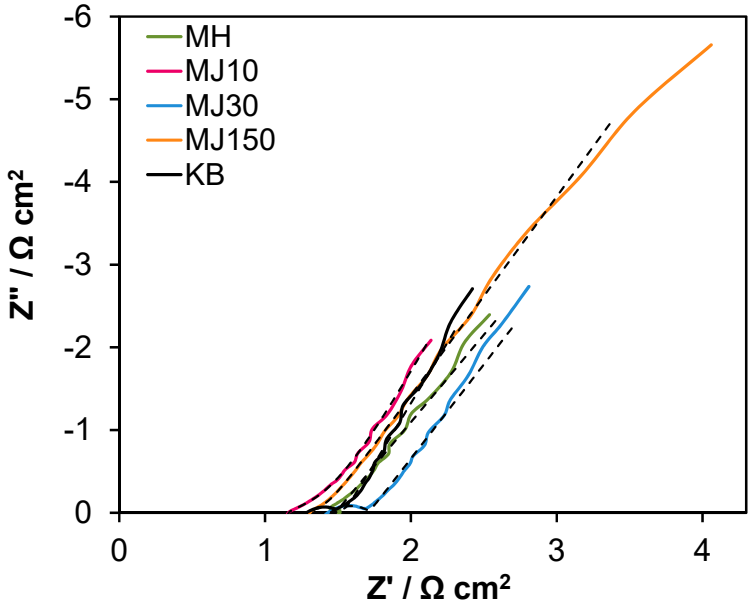

Figure S3. Impedance spectra of cells using KB, MH, MJ10, MJ30, and MJ150 cathodes at 150 °C. Black dotted lines represent curve-fitting results.

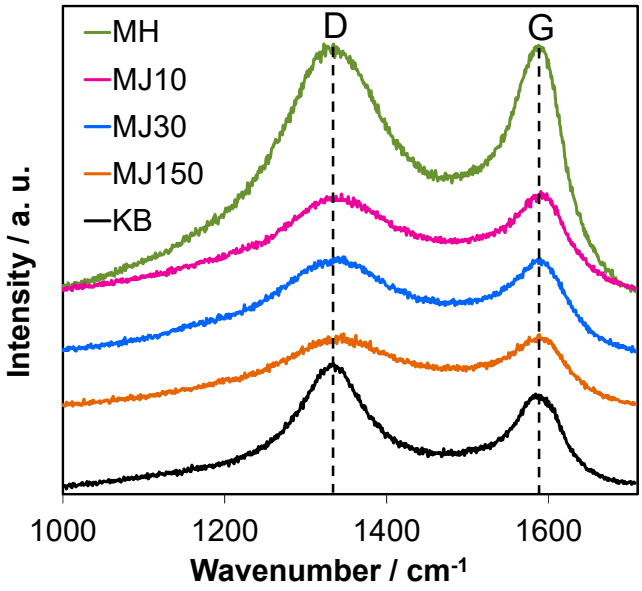

Figure S4. Raman spectra of KB, MH, MJ10, MJ30, and MJ150.

Table S1. Textural properties of AB, Vulcan, and KB.

	V_p (cm^3 g^{-1}) (BJH)	d_{av} (nm) (BJH)	S_{BET} (m^2 g^{-1}) (BET)	
KB	2.40	5.9	1830	This work
Vulcan XC-72R	1.34	5.0	223.2	*Ref. 1*
AB	0.99	2.7	1625	*Ref. 2*

V_p = pore volume determined by BJH method from the adsorption branch of the isotherm; d_p = BJH pore diameter; d_{av} = BJH pore average diameter. S_{BET} = specific surface area determined by BET analysis from the adsorption branch of the isotherm.

Table S2. Fitted values of R_{bulk}, R_1, and W of cells using MH, MJ10, MJ30, and MJ150 cathodes.

	R_{bulk} / Ω cm^2	R_1 / Ω cm^2	W / Ω cm^2
MH	1.464	0.809	35.55
MJ10	1.182	0.229	28.12
MJ30	1.383	0.326	34.18
MJ150	1.330	10.33	42.17
KB	1.290	0.275	60.99

Data for the cell using the KB cathode are included for comparison.

References

1. Ignaszak, A.; Ye, S. Y.; Gyenge, E. A study of the catalytic interface for O_2 electroreduction on Pt: The interaction between carbon support meso/microstructure and ionomer (Nafion) distribution. *J. Phys. Chem. C* **2009**, *113,* 298–307.

2. Tashima, D.; Kurosawatsu, K.; Uota, M.; Karashima, T.; Otsubo, M.; Honda, C.; Sung, Y. M. Space charge distributions of an electric double layer capacitor with carbon nanotubes electrode. *Thin Solid Films* **2007**, *515,* 4234–4239.