Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supplementary Material

High performance of flow-type one-compartment hydrogen peroxide fuel cell using buckypaper and narrow fuel pathway in physiological condition

Sieun Jeon[a], Heeyeon An[b], Yongjin Chung[a,b,*]

1. Figures

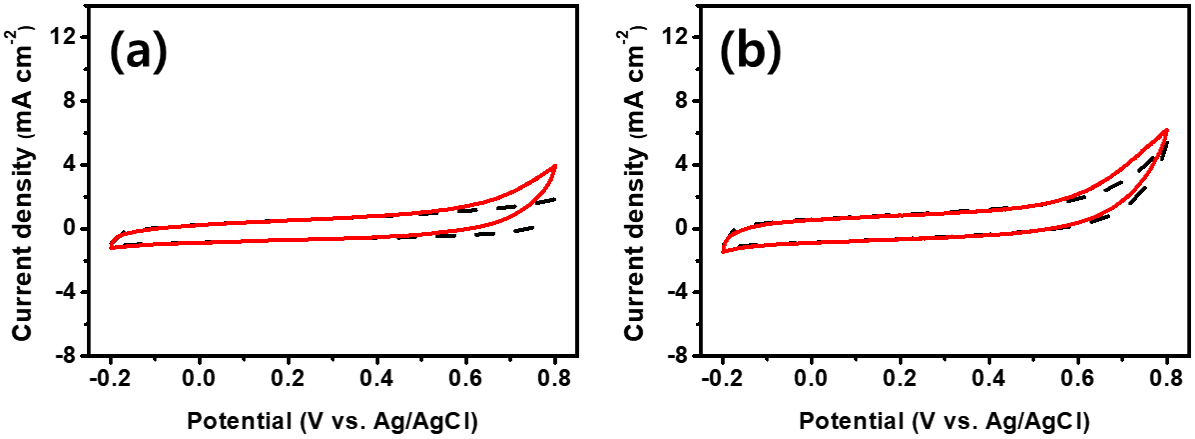

Figure S1. CVs of BP (CNT and SDBS composite) and BP/PEI, when 10 mM of H_2O_2 was injected. For the tests, The N_2-purged 0.1 M PBS solution (pH 7.4) was employed as the electrolyte, and the scan rate was 20 mV s^{-1}.

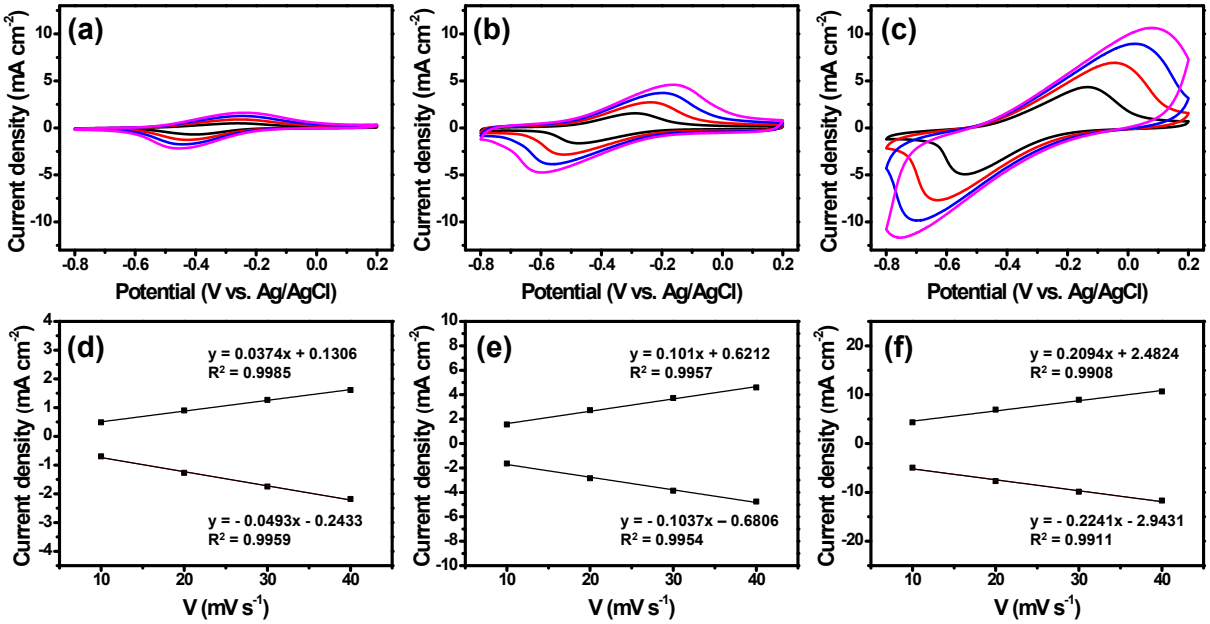

Figure S2. CVs of (a) CNT/PEI/hemin, (b) BP/hemin, and (c) BP/PEI/hemin, and the relationship of scan rate and peak current density of (d) CNT/PEI/hemin, (e) BP/hemin, and (f) BP/PEI/hemin. The N_2-purged 0.1 M PBS solution (pH 7.4) was employed as the electrolyte, and the scan rates varied as 20, 40, 60, 80, 100, 120, 140, and 160 mV s^{-1}.

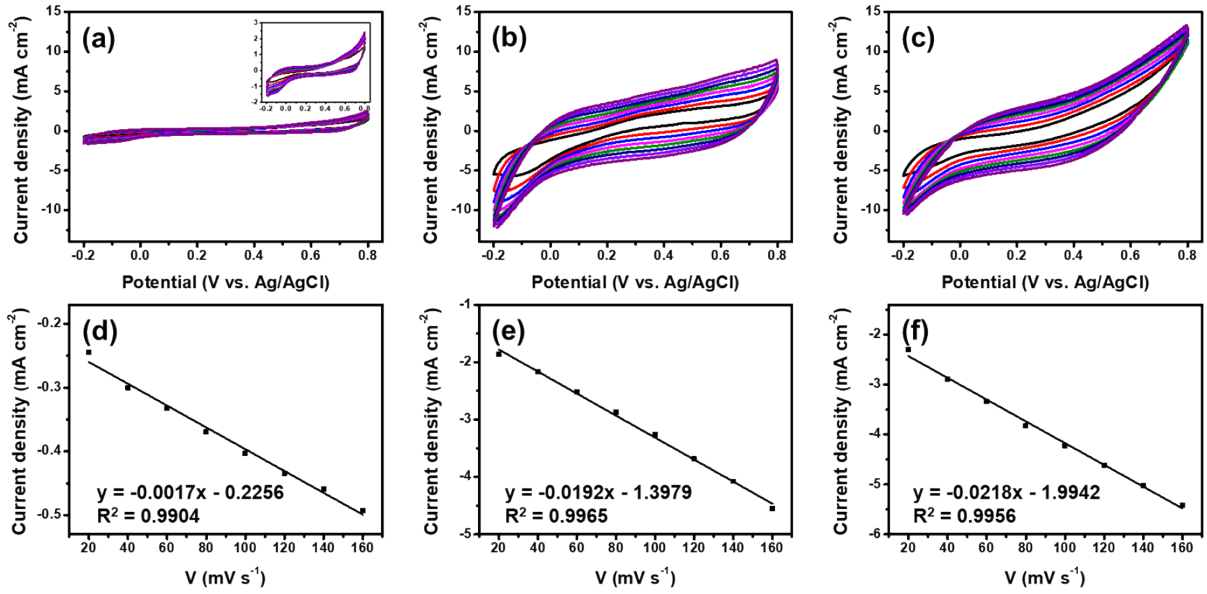

Figure S3. The CVs of (a) CNT/PEI/hemin, (b) BP/hemin, and (c) BP/PEI/hemin, and the plot of scan rate vs. peak current density of (d) CNT/PEI/hemin, (e) BP/hemin, and (f) BP/PEI/hemin. The N_2-purged 10 mM H_2O_2 in 0.1 M PBS solution (pH 7.4) was employed as the electrolyte, and the scan rates were varied as 20, 40, 60, 80, 100, 120, 140, and 160 mV s^{-1}.

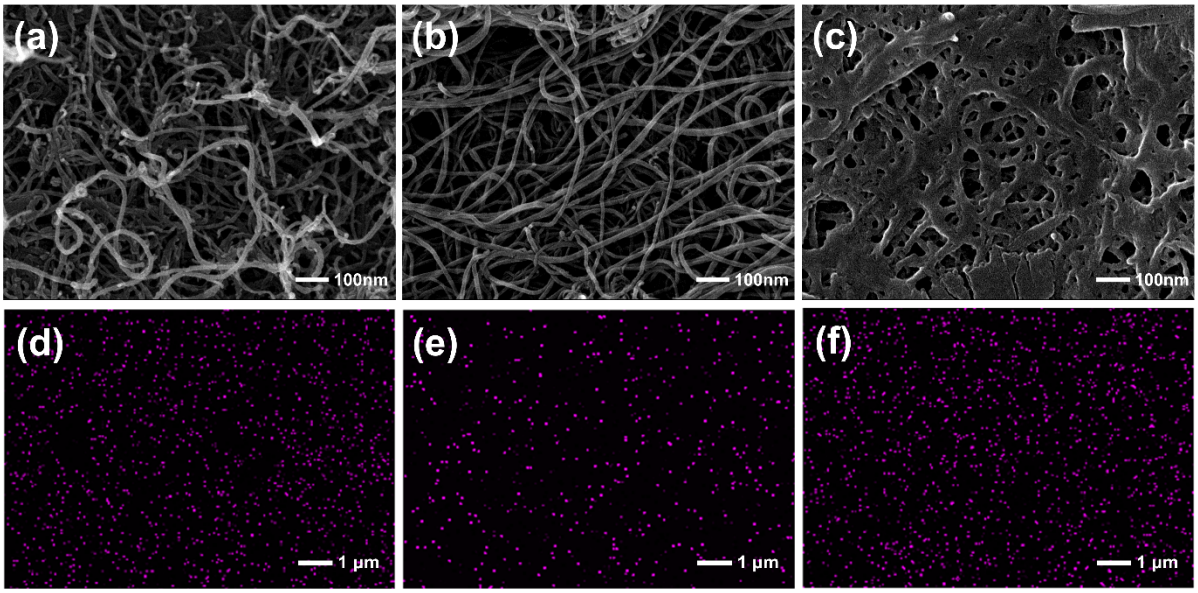

Figure S4. SEM images of (a) CNT/PEI/hemin, (b) BP/hemin, and (c) BP/PEI/hemin, and the elemental distribution maps (Fe K series) of (d) CNT/PEI/hemin, (e) BP/hemin, and (f) BP/PEI/hemin measured using SEM-EDS.

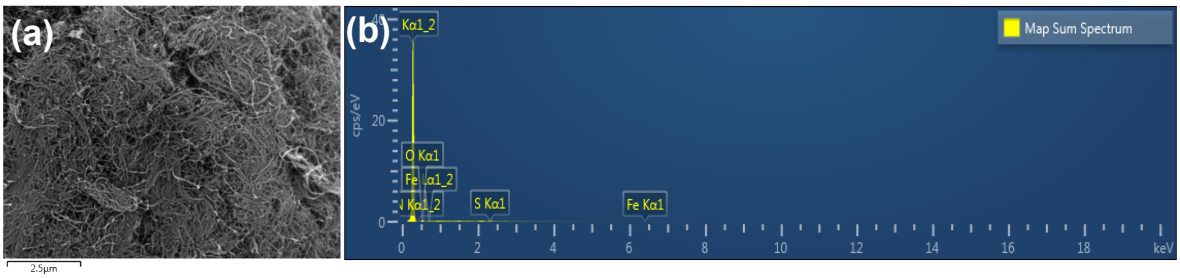

Figure S5. (a) SEM images of CNT surface and (b) the spectra graphs of the elements.

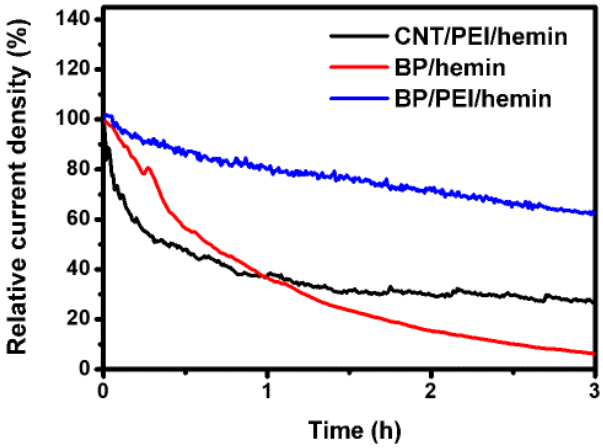

Figure S6. Chronoamperometric responses at 0.2 V of CNT/PEI/hemin, BP/hemin, and BP/PEI/hemin to 10 mM H_2O_2 in N_2-purged 0.1 M PBS.

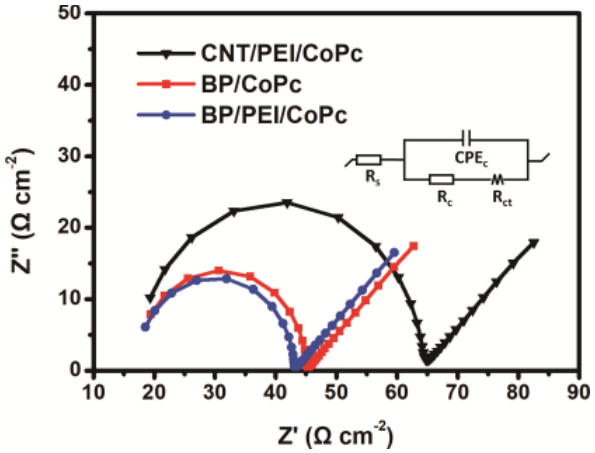

Figure S7. EIS plots of CNT/PEI/CoPc, BP/CoPc, and BP/PEI/CoPc with 5 mM potassium ferrocyanide in 0.1 M PBS. (frequency range was from 10 mHz to 7 MHz).

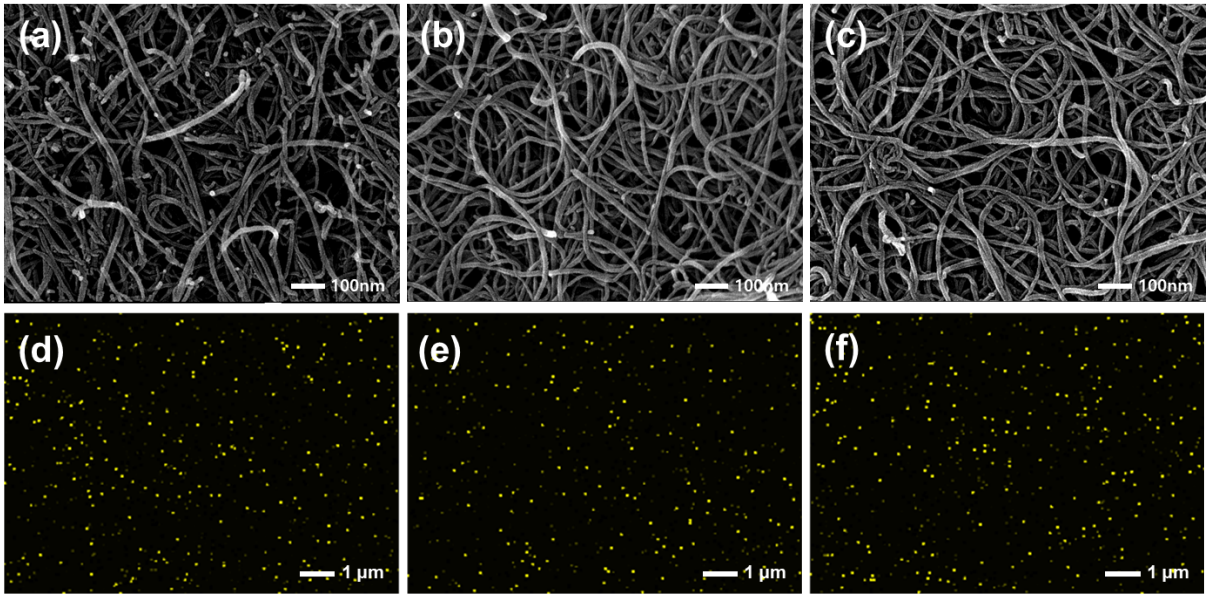

Figure S8. SEM images of (a) CNT/PEI/CoPc, (b) BP/CoPc, and (c) BP/PEI/CoPc, and the elemental distribution maps (Co K series) of (d) CNT/PEI/CoPc, (e) BP/CoPc, and (f) BP/PEI/CoPc measured using SEM-EDS.

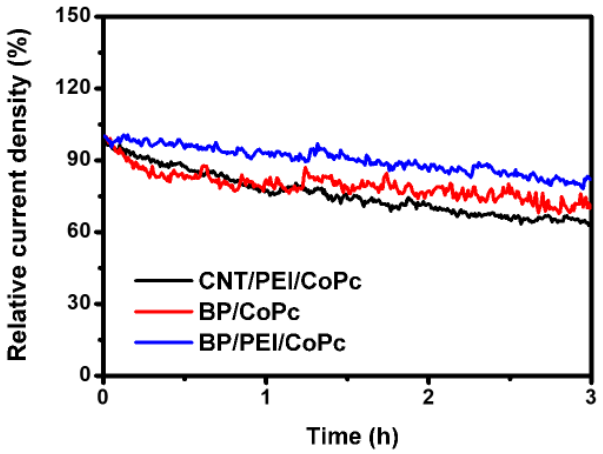

Figure S9. Chronoamperometric responses at 0.2 V of CNT/PEI/CoPc, BP/CoPc, and BP/PEI/CoPc to 10 mM H_2O_2 in N_2-purged 0.1 M PBS.

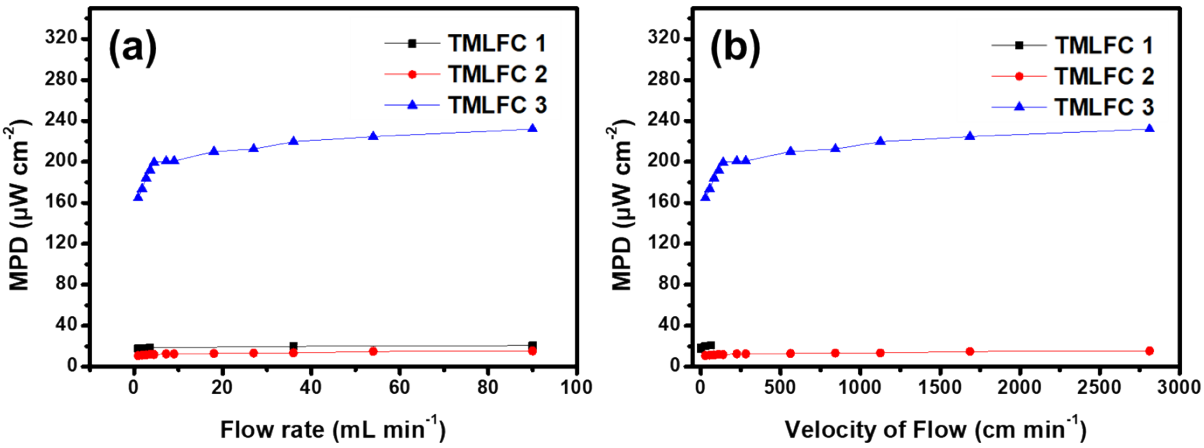

Figure S10. Plot of MPD using TMPFC 1, 2, and 3 vs. (a) flow rate or (b) velocity of flow. For the tests, 10 mM H_2O_2 in 0.1 M PBS fuel was circulated.

2. Table

Table S1 The R_s, R_{ct}, and CPE_c of CNT/PEI/hemin, BP/hemin, and BP/PEI/hemin analyzed from the EIS spectra.

	R_s **[Ω]**	**R_{ct}** **[Ω]**	**CPE_c** **[F]**
CNT/PEI/hemin	17.05	49.08	3.094×10^{-8}
BP/hemin	17.02	30.01	2.539×10^{-8}
BP/PEI/hemin	17.04	25.03	3.525×10^{-8}

Table S2 The R_s, R_{ct}, and CPE_c of CNT/PEI/CoPc, BP/CoPc, and BP/PEI/CoPc analyzed from the EIS spectra.

	R_s [Ω cm^{-2}]	R_{ct} [Ω cm^{-2}]	CPE_c [F cm^{-2}]
CNT/PEI/CoPc	17.03	47.10	1.527 x 10^{-8}
BP/CoPc	17.01	28.04	1.493 x 10^{-8}
BP/PEI/CoPc	17.06	26.01	1.874 x 10^{-8}

Table S3 Element mass fractions of C, O, and Fe, and weight ratio of Fe to C in catalysts measured by

	Pump speed (rpm)	Measured flow rate (ml min^{-1})			
		1	2	3	average
1/8 inch silicone tubing	10	9.08	9.11	9.0	9.06 ± 0.046
	100	90.2	91.8	89.2	90.4 ± 1.071
1 mm cell	10	9.02	9.08	9.01	9.04 ± 0.031
	100	89.9	90.3	90.2	90.1 ± 0.170
1 mm cell, separator	10	8.97	9.19	9.0	9.05 ± 0.097
	100	92.3	87.3	91.1	9.03 ± 2.131

SEM-EDS.