Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Electronic Supplementary Information (ESI)

The impact of microstructural features of carbon support on the electrocatalytic hydrogen evolution reaction

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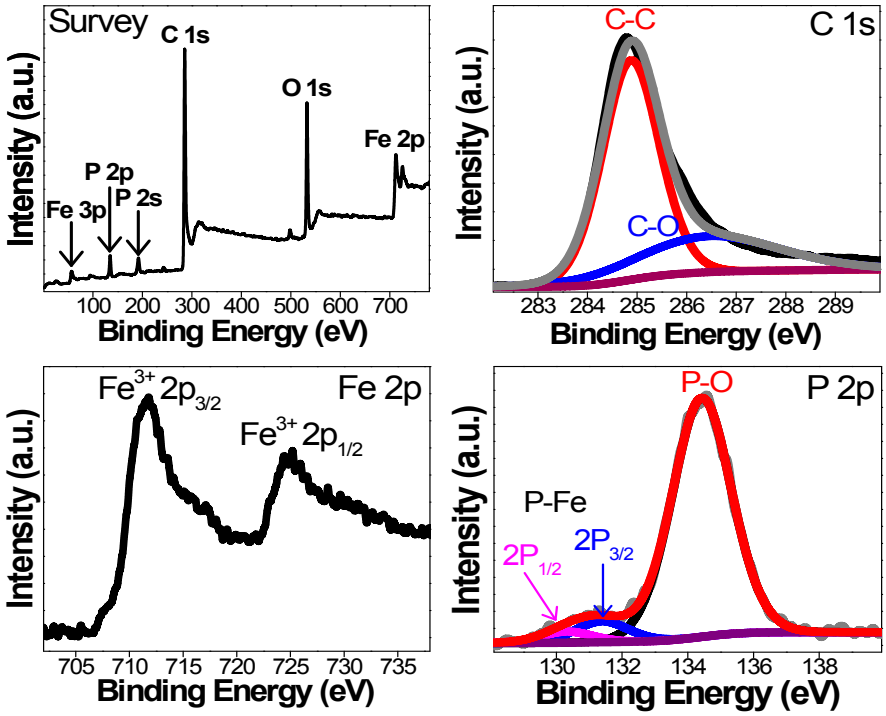

Fig. S1 XPS signatures of FeP/CNT.

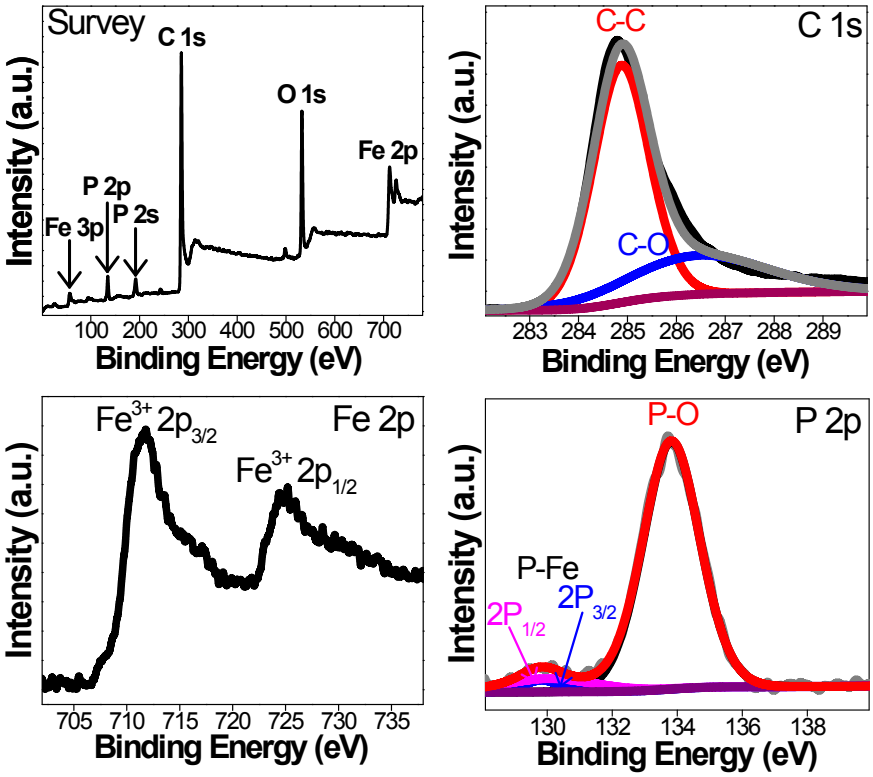

Fig. S2 XPS signatures of FeP/XC.

Table S1 *Results of elemental analyses of FeP/CN, FeP/CNT and FeP/XC.*

Electrocatalyst	Theoretical composition			Calculated composition		
	Fe%	P%	C%	Fe%	P%	C%
FeP/CN	33.1	17.4	49.5	32.4	20.3	47.3
FeP/CNT	33.1	17.4	49.5	32.9	20.2	46.9
FeP/XC	33.1	17.4	49.5	32.6	18.8	48.6

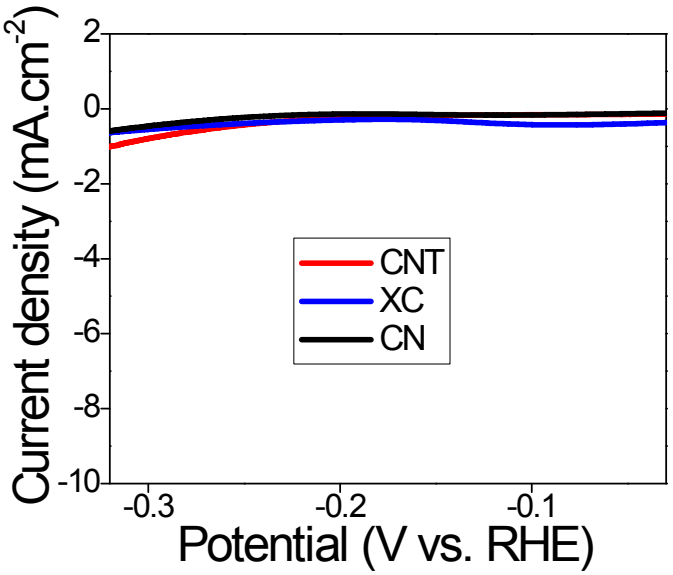

Fig. S3 Comparative polarization curves of pure XC, CNT and CN in 0.5 M H_2SO_4.

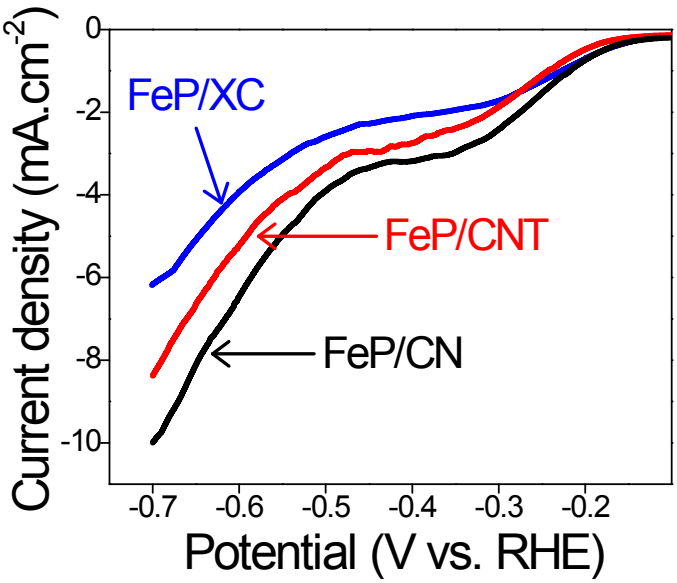

Fig. S4 Comparative polarization curves of FeP/XC, FeP/CNT and FeP/CN in phosphate buffer pH 7.

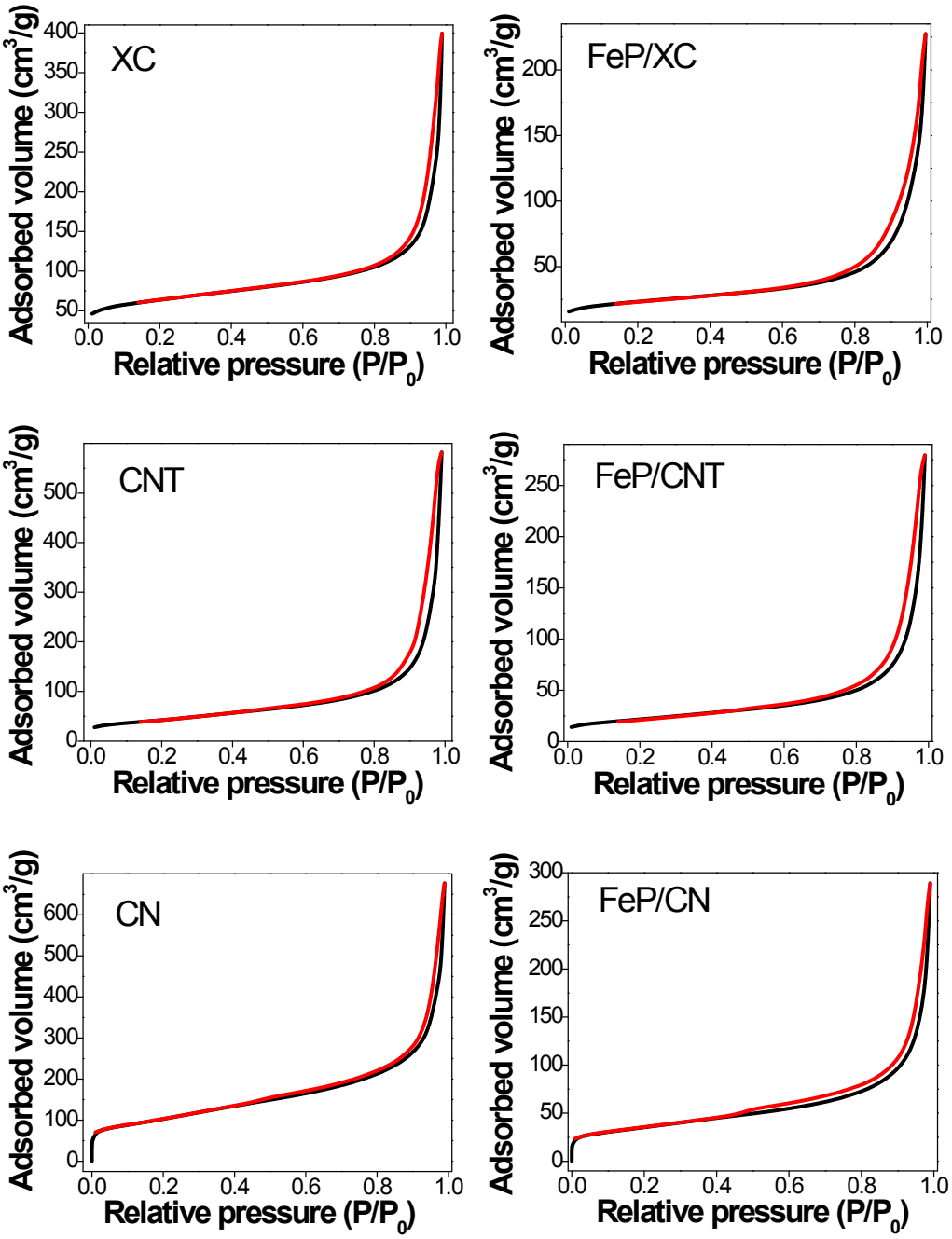

Fig. S5 Nitrogen adsorption-desorption isotherms of pristine carbon and FeP-modified carbon.

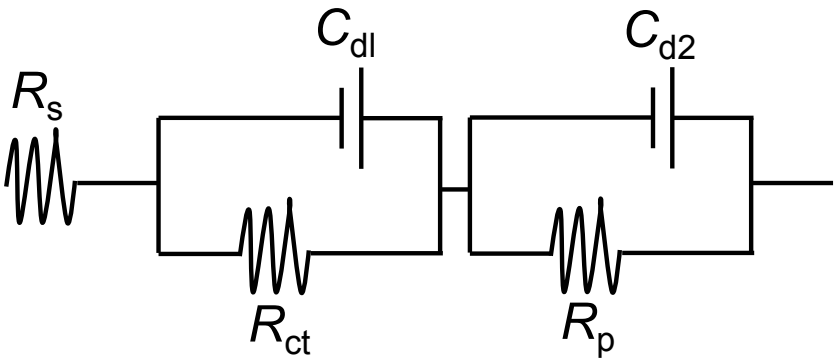

Fig. S6 Two time constant electrical equivalent circuit model utilized to fit the electrochemical impedance (EIS) results of hydrogen evolution reaction. R_s – series resistance, C_{dl} and C_{d2} are double layer capacitance, R_{ct} – charge transfer resistance for HER, R_p – resistance related to the surface porosity.

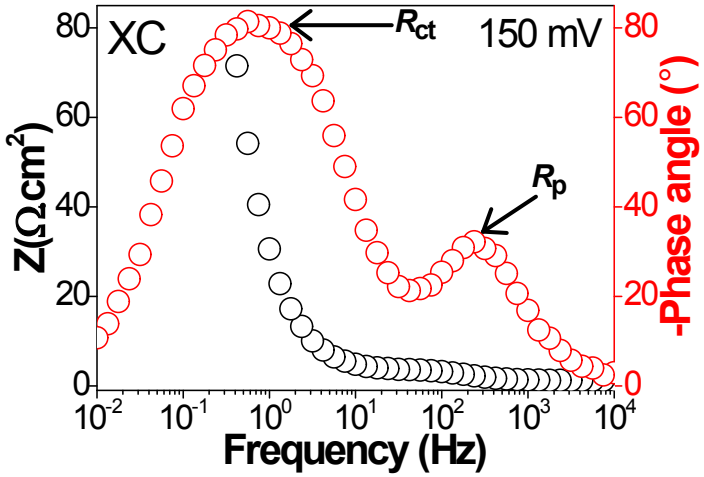

Fig. S7 Representative Bode plot of pristine XC carbon electrodes showing the presence of two-time constants.

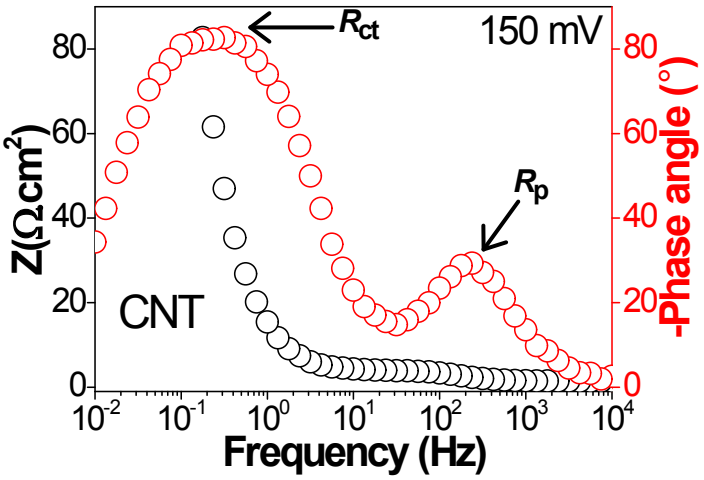

Fig. S8 Representative Bode plot of pristine CNT electrode showing the presence of two-time constants.

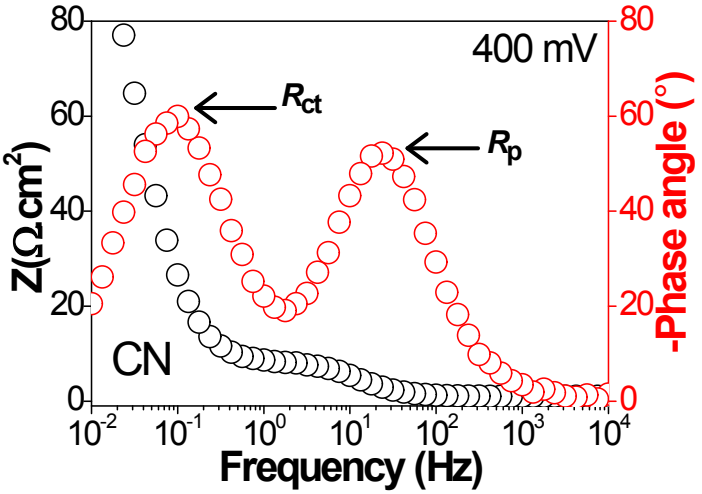

Fig. S9 Representative Bode plots of pristine nanosheets electrode showing the presence of two-time constants.

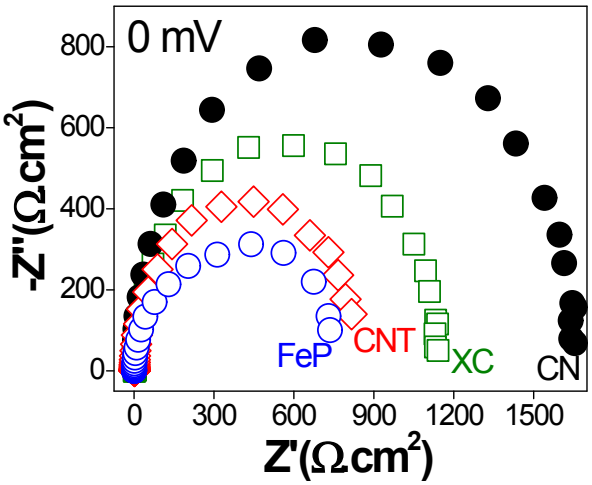

Fig. S10 Nyquist plots of pristine carbon and FeP electrodes showing intrinsic electrical conductivity.

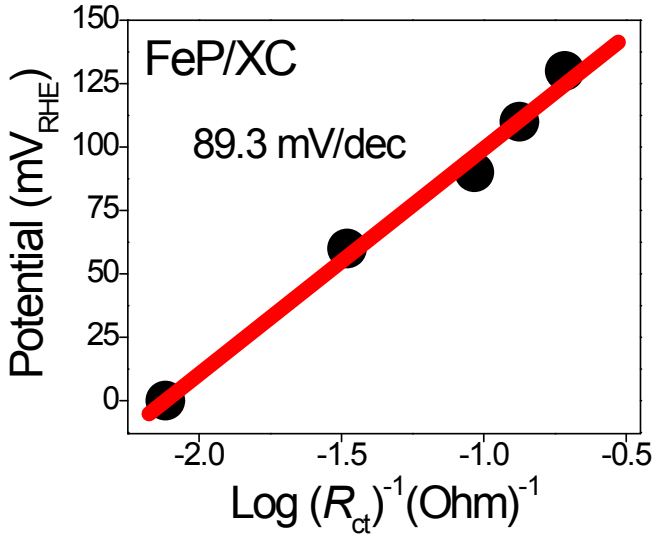

Fig. S11 Tafel slope of FeP/XC.

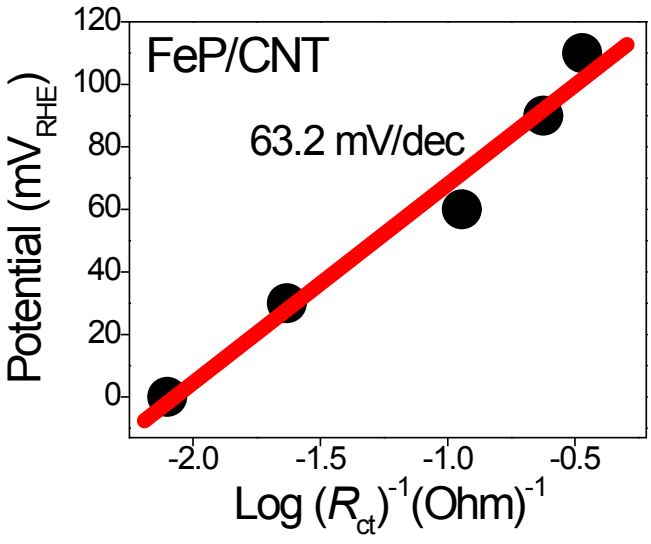

Fig. S12 Tafel slope of FeP/CNT.

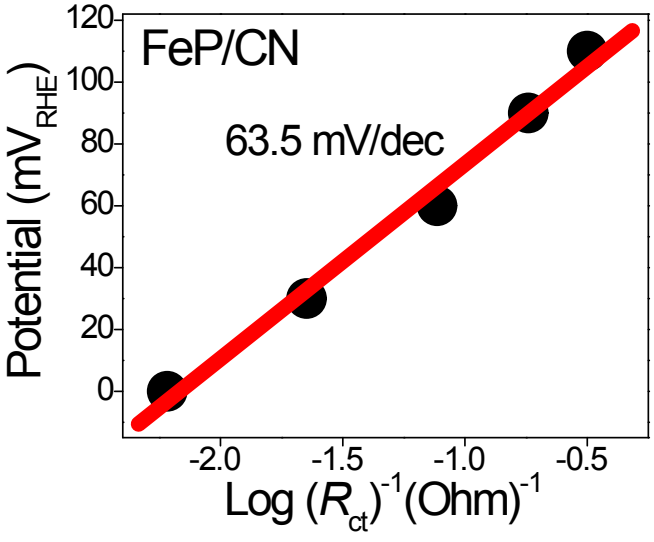

Fig. S13 Tafel slope of FeP/CN.

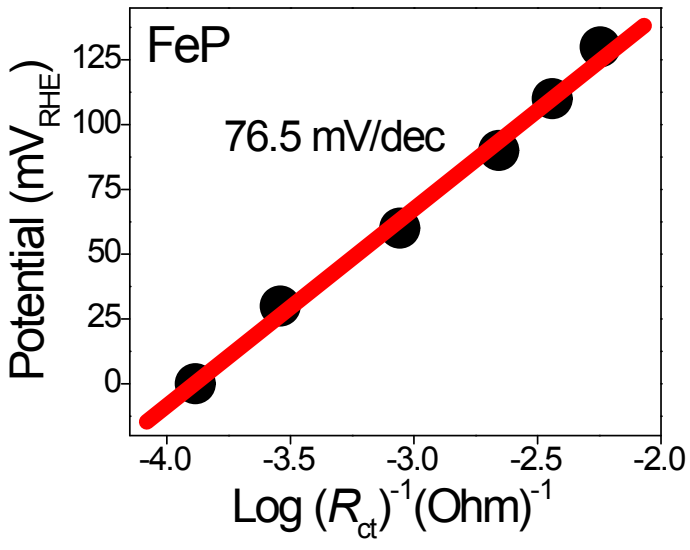

Fig. S14 Tafel slope of pure FeP.

Table S2 *Electrochemical impedance values of pristine carbon and pure FeP obtained by fitting their Nyquist Plots.*

Potential (mV)	CN			CNT			XC			FeP	
	R_s	R_p	R_{ct}	R_s	R_p	R_{ct}	R_s	R_p	R_{ct}	R_s	R_{ct}
	$\Omega.cm^2$			$\Omega.cm^2$			$\Omega.cm^2$			$\Omega.cm^2$	
0	3.32	5.91	1685	0.72	1.22	860.7	0.88	1.42	1146	0.87	785.3
30	3.29	6.30	1520	1.12	1.30	804.5	0.83	1.50	870.7	0.85	457.7
60	3.07	5.8	1408	0.86	1.54	603.1	0.71	1.26	788.3	0.81	99.3
90	2.87	5.48	1323	0.57	1.00	403.9	0.78	1.03	731.8	0.83	58.5
110	2.35	5.3	1207	1.48	1.25	357.3	1.13	1.30	657	0.88	31.8
130	2.76	4.67	1126	0.76	1.45	243.5	1.21	1.76	612.9	0.73	16.4
150	2.44	5.5	1006	1.03	1.30	97.7	1.23	1.30	563.2	0.77	11.6

Table S3 *Electrochemical impedance values of FeP-modified carbon obtained by fitting their Nyquist Plots.*

Potential (mV)	FeP/CN			FeP/CNT			FeP/XC		
	R_s	R_p	R_{ct}	R_s	R_p	R_{ct}	R_s	R_p	R_{ct}
	($\Omega.cm^2$)			($\Omega.cm^2$)			($\Omega.cm^2$)		
0	0.99	0.17	148.2	0.98	0.15	126.1	0.946	0.15	131.2
30	0.96	0.17	45.3	0.95	0.17	42.8	0.941	0.15	110.5
60	0.94	0.16	10.5	0.93	0.22	8.8	0.922	0.08	30.2
90	0.99	0.17	5.25997	0.91	0.23	4.21	0.932	0.1	10.8
110	0.92	0.15	3.07	0.82	0.12	2.96	1.01	0.07	7.5
130	0.94	0.17	2.67	0.97	0.12	2.5	0.99	0.01	5.2
150	0.90	0.16	2.28923	0.85	0.16	2.18	0.903	0.03	4.1

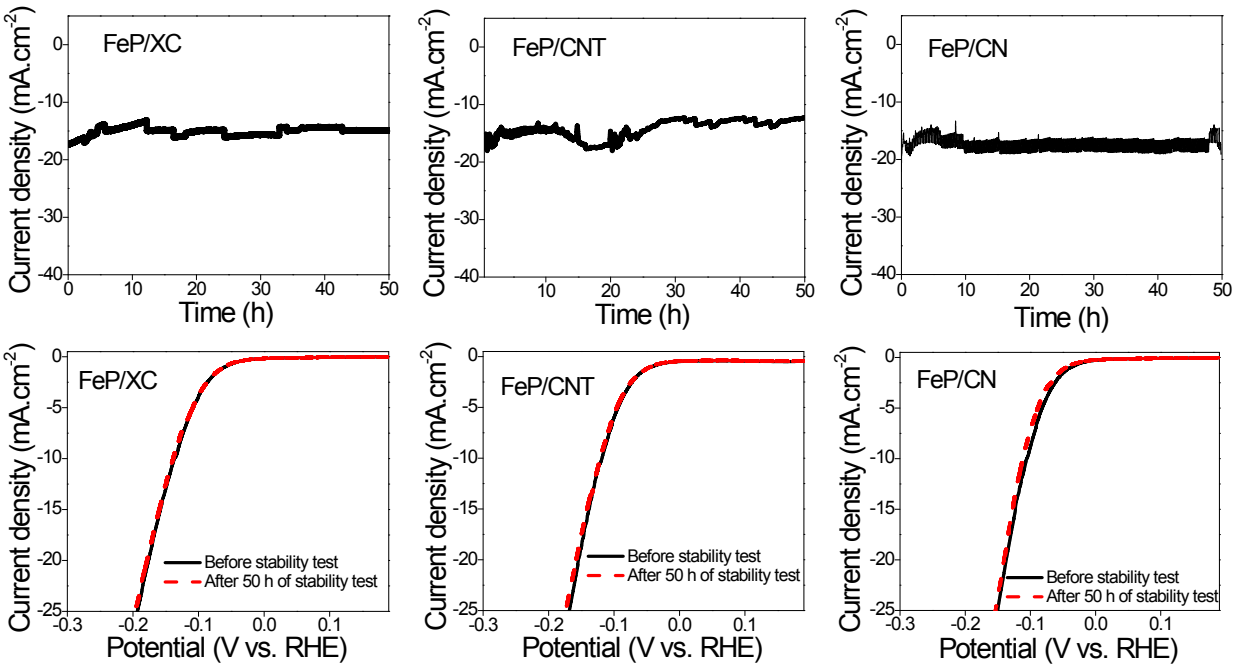

Fig. S15 Current-time and polarization curves obtained before and after potentiostatic experiments.