Electronic Supplementary Information

Enhancement of carbon supports available specific surface area for boosting the electroactivity of nanostructured Pt catalysts

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Table S1: XRD parameters of supported Pt nanoparticles for different (hkl) planes

(hkl) plane	Catalyst	2θ (°)	$d_{(hkl)}$ (Å)	$a_{(hkl)}$ (Å)	a_{Bragg} (Å)	L_V (nm)
(111)	Pt/C-nt	39.85	2.261	3.916	3.915	4.29
	Pt/C	39.93	2.261	3.917	3.907	4.11
	Pt/KB-nt	39.90	2.262	3.918	3.910	3.13
	Pt/KB	39.84	2.260	3.914	3.916	2.85
(200)	Pt/C-nt	46.58	1.954	3.908	3.900	4.41
	Pt/C	46.30	1.964	3.928	3.919	3.47
	Pt/KB-nt	46.40	1.956	3.913	3.911	3.66
	Pt/KB	46.30	1.960	3.920	3.918	3.64
(220)	Pt/C-nt	67.47	1.385	3.917	3.923	4.73
	Pt/C	67.81	1.384	3.915	3.906	3.77
	Pt/KB-nt	67.90	1.383	3.913	3.901	3.77
	Pt/KB	67.73	1.385	3.917	3.910	3.46
(311)	Pt/C-nt	81.60	1.182	3.920	3.910	3.77
	Pt/C	81.67	1.181	3.917	3.907	3.32
	Pt/KB-nt	81.70	1.181	3.917	3.906	2.44
	Pt/KB	81.56	1.182	3.920	3.911	2.85
(222)	Pt/C-nt	86.21	1.130	3.914	3.905	4.28

	Pt/C	86.31	1.129	3.911	3.901	4.54
	Pt/KB-nt	86.50	1.127	3.905	3.894	3.76
	Pt/KB	86.29	1.129	3.912	3.902	3.59
(400)	Pt/C-nt	104.00	0.980	3.920	3.910	4.80
	Pt/C	104.20	0.978	3.914	3.905	4.65
	Pt/KB-nt	104.00	0.976	3.905	3.910	3.48
	Pt/KB	103.95	0.980	3.921	3.911	4.29
(331)	Pt/C-nt	118.55	0.898	3.915	3.906	4.23
	Pt/C	118.70	0.897	3.912	3.903	4.07
	Pt/KB-nt	119.00	0.896	3.907	3.900	3.13
	Pt/KB	118.50	0.898	3.916	3.907	4.00
(420)	Pt/C-nt	123.60	0.876	3.918	3.909	4.23
	Pt/C	123.70	0.875	3.916	3.907	4.40
	Pt/KB-nt	123.90	0.875	3.913	3.903	3.38
	Pt/KB	123.55	0.876	3.919	3.908	3.50

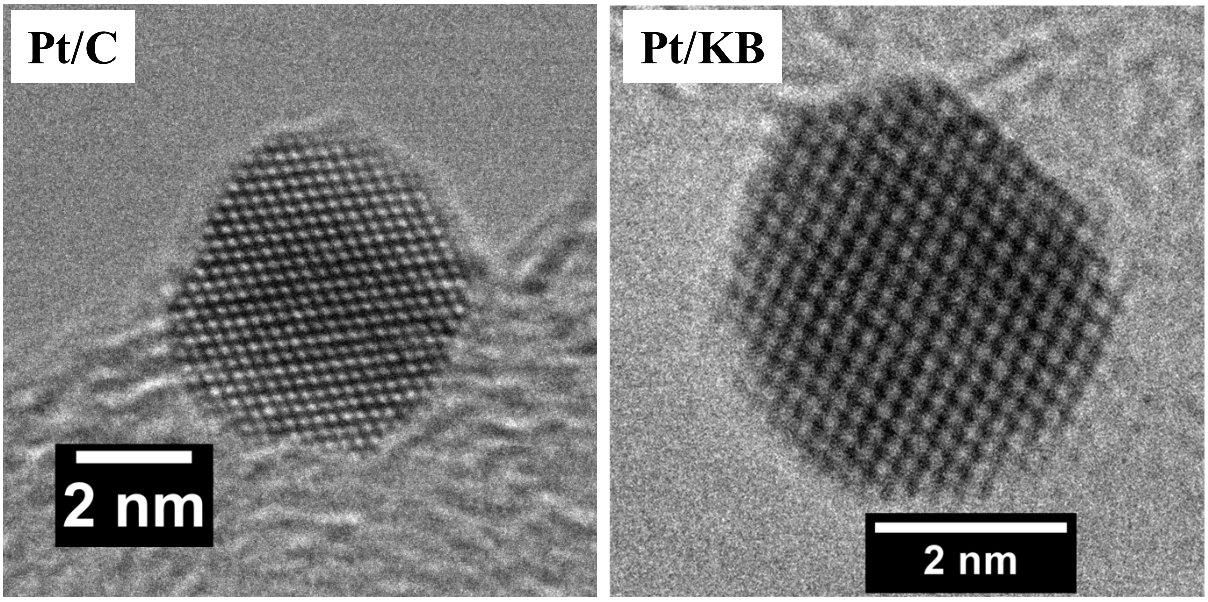

Fig. S1. High resolution transmission microscopy of Pt/C and Pt/KB highlighting the particle shape.

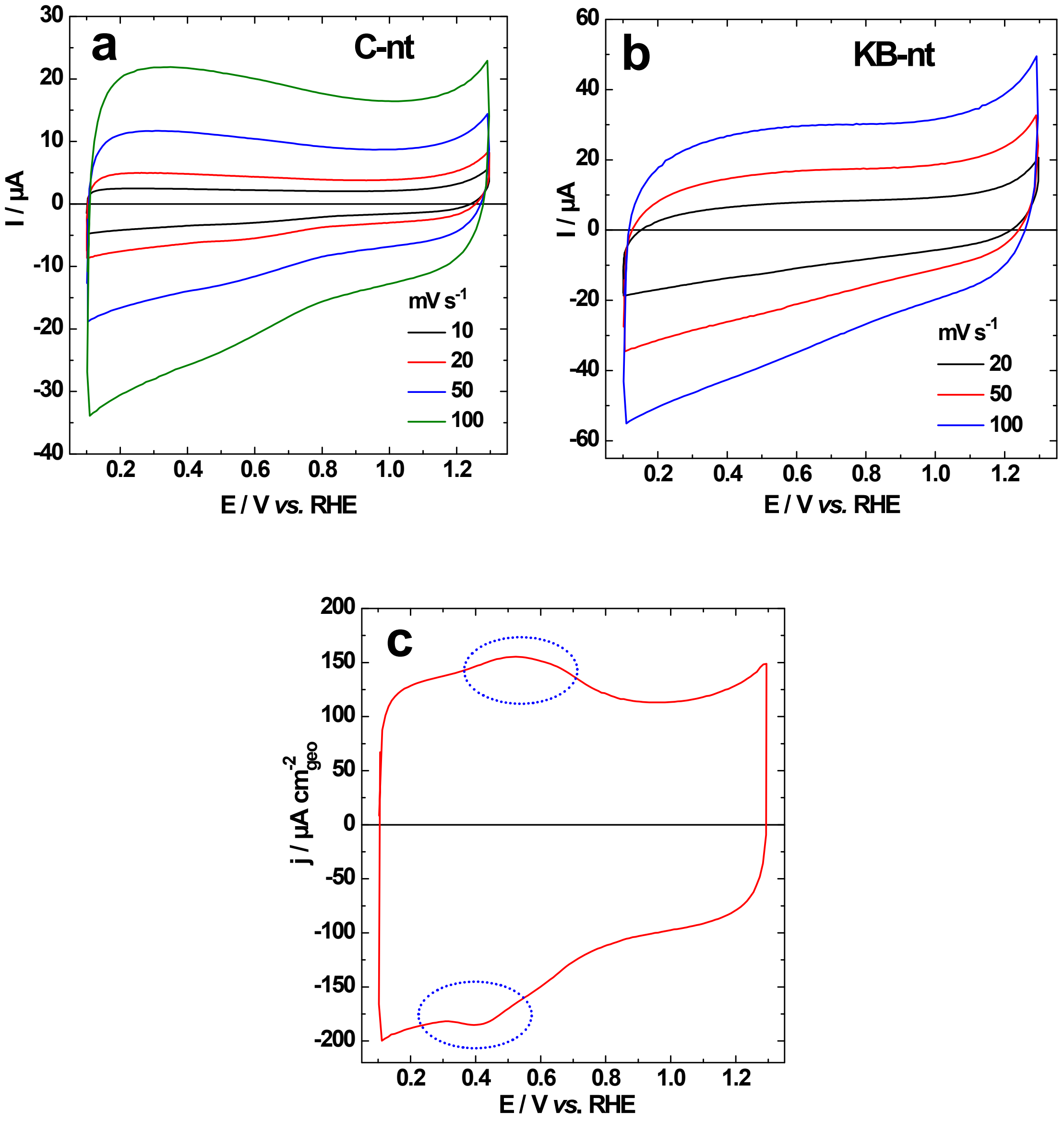

Fig S2. Cyclic voltammograms recorded in N_2-satured 0.1 mol L^{-1} NaOH solution at 25 °C on (a) C-nt and (b) KB-nt and c) C in 0.2 mol L^{-1} PBS solution at 37 °C (pH 7.4) at 20 mV s^{-1}.

Description of the method used for the electrochemical surface area (ECSA) evaluation

The determination of the specific electrochemical active surface (ECSA also referred as SECSA or S_{ECSA} or) of metal can be done by various methods from the Eq. 1. Among of them, we have the adsorption/desorption of hydrogen, stripping of probe molecule (CO), stripping of under potential deposition (UPD) or reduction of oxide.[1-4] A charge density of 210 µC cm^{-2} ($Q_{monolayer}$) is associated to the adsorption/desorption of the formed PtH monolayer. Fig. S3a shows the integrated region. The exchange charge ($Q_{exchanged\ charge}$) was obtained by using Eq. (2) by using Origin8® software. To access this charge, another old method can be used. It is the so-called "weighing method". This charge is calculated by using the Eq. (3) which establishment will not be done herein. This method use tracing paper. Briefly, it involves cutting a known surface of tracing paper and weighing it. After the weighing of the cut portion of this paper, corresponding to the area of interest, the assessment of the exchange charge is an easy task. The variables *a*, *b*, *x*, *y* and *v* used in Eq. (3) are represented on Fig. S3b. The parameter "s_0" is the surface of the tracing paper which is cut as reference. The variable "m_0" is the weight of this tracing paper while "m_1" is the weight of the shaded curve printed on any paper and modeled (on the tracing paper).

$$\mathrm{SA\ (cm^2)} = \frac{Q_{\mathrm{exchanged\ charge}}(\mu\mathrm{C})}{Q_{\mathrm{monolayer}}(\mu\mathrm{C\ cm^{-2}})} \tag{1}$$

$$Q_{\mathrm{exchanged\ charge}} = \frac{1}{v}\left(\int_{E_{\mathrm{initial}}}^{E_{\mathrm{final}}} i(E)dE\right) \tag{2}$$

$$Q_{\mathrm{exchanged\ charge}} = \frac{m_1}{m_0} \times \frac{s_0}{x \times y} \times \frac{a \times b}{v} \tag{3}$$

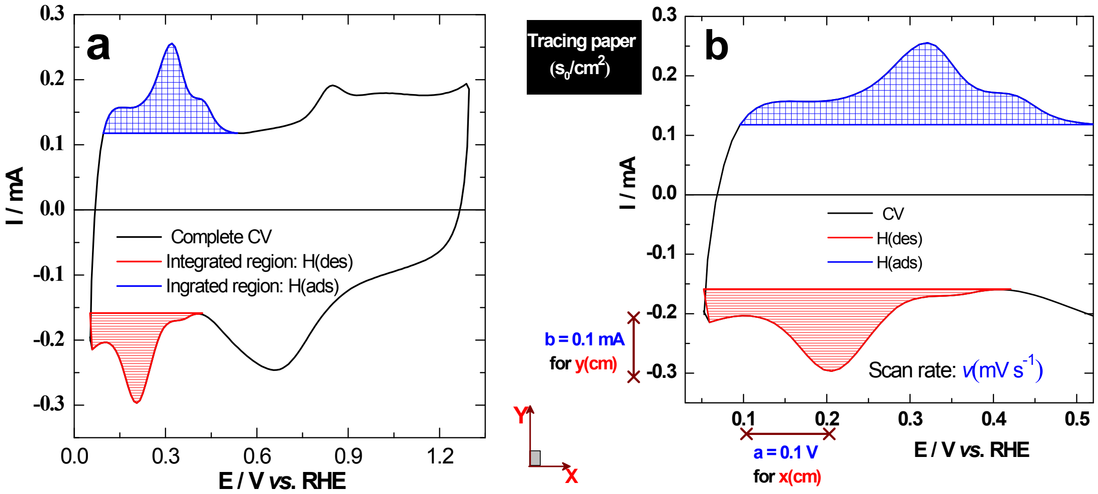

Fig S3. Illustration of the method used for the real active surface area determination by CV, using Pt/KB electrode as example. The hatched areas correspond to a) integration region on Origin® software b) the cut area for the "weighing method". The experiments were conducted in 0.1 mol L^{-1} NaOH at 50 mV s^{-1} scan rate.

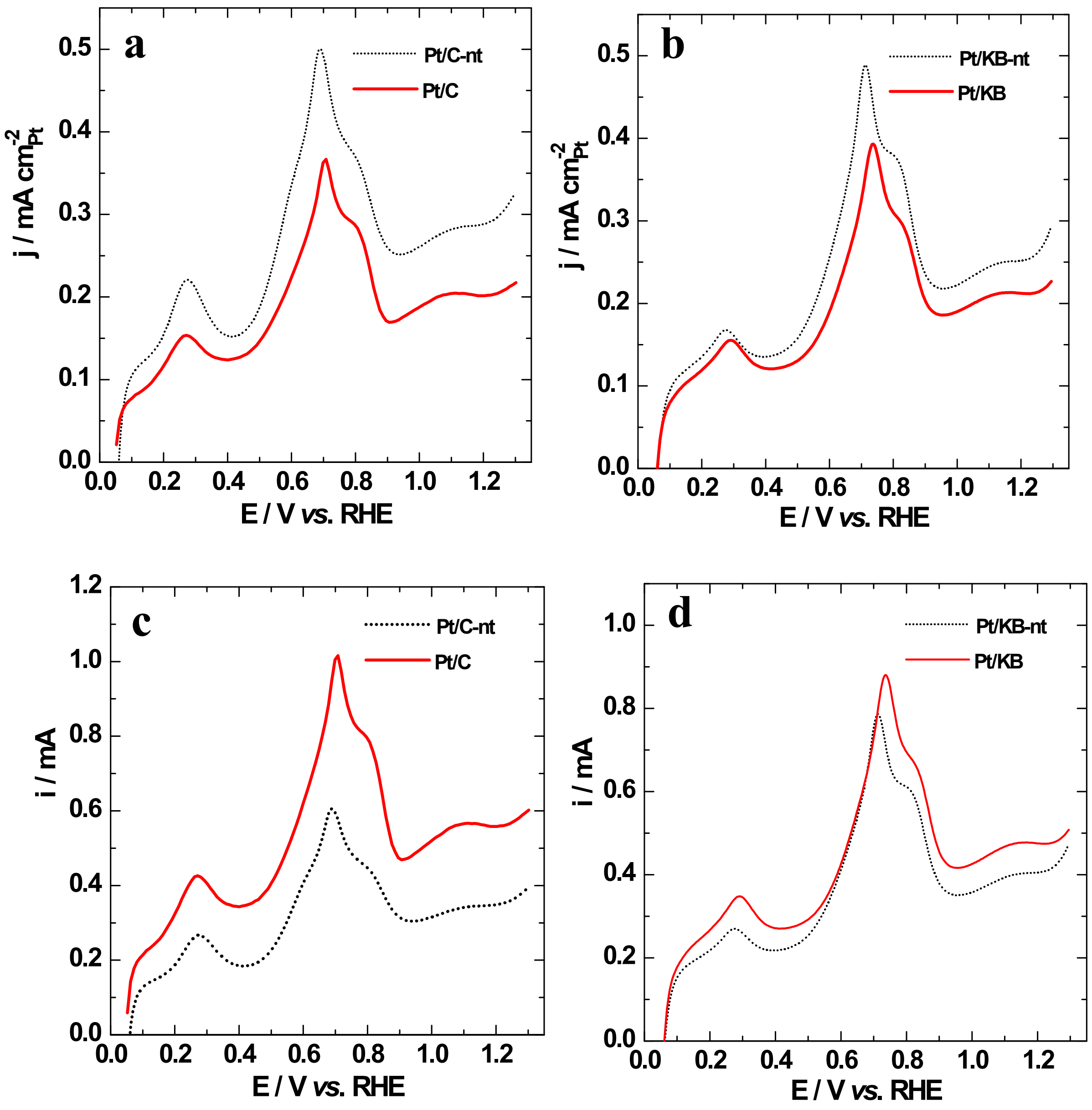

Fig. S4. Polarization curves recorded at 20 mV s^{-1} in 0.1 mol L^{-1} NaOH + 10 mmol L^{-1} glucose at 25 °C with (a) Vulcan XC 72R and (b) KB EC-600JD as supports. Note: Current densities are normalized using Pt active surface area in (a) and (b). (c) Shows the pristine produced current during before the normalization in picture (b).

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