Supporting information (SI)

Supporting information No.1;

In general, the diffusion-limited current density (I_d) can be estimated by using Levich's equation $(1)^1$.

$$I_{d} = 0.62 \text{ nFAD}^{2/3} \text{Cv}^{-1/6} \omega^{1/2} \quad (1)$$

where n is the number of transferred electrons (=4), F is the Faraday constant (=96490Cmol⁻¹), A is geometric surface area, D is the diffusion coefficient (= 1.15×10^{-5} cm²sec⁻¹)¹, C is the solubility (= 1.61×10^{-6} molcm⁻³)¹, v is the kinematic viscosity (=0.00839cm²sec⁻¹)² and ω is the angular velocity (=14.47sec⁻¹).

The geometrical surface area in the present work was calculated by the Levich's equation (1). In this case, the diffusionlimited current density was estimated using Figure 1 for supporting information (SI). And the geometric surface area observed for Pt/C and Pt-CeO_x/C were 0.108cm² and 0.099cm² on Au disk, respectively (Au electrode area=0.2cm²). The current densities of Figure 1 and Figure 2 were normalized by using aforementioned geometrical surface area.

References:

 [1] Bard, A. J.; Faulkner, L. R. *Electrochemical Methods: Fundamentals and Applications*, 2nd ed.; Wiley & Sons: New York, 2000, 339.

[2]Ioe, R.N; Wesson G.D.; Kalu, E.E. Evaluation of oxygen transport parameters in H₂SO₄-CH₃OH mixtures using electrochemical methods. *J. Electrochem. Soc.*, **2000**, 147, 2445-2450.

[3]Jiang, R.; Chu,D.; Multiple small potential steps at a rotating disk electrode and applications. *Electrochimica Acta*, **2000**, 45, 4025-4030.

Supporting information No.2;

The CV curves for the estimation of Pt particle sizes by using CO stripping method and for the different pre-treatment experiments were shown in Figure 2(A) for SI and Figure 2(B) for SI, respectively.

Those are just for the demonstration data in the present work.

Supporting information No.3;

The comparison between the normalized activities by using geometric surface area (i.e. specific activity) and the mass activities observed for $Pt-CeO_x/C$ and Pt/C were demonstrated in Figure 3 for SI. Since the observed upper limit potential dependence of activity between the normalized activities by geometric surface area and the mass activities for both electro-catalysts are same, it is concluded that the comparison in Figure 2 of text is reliable.



Figure 1 for SI Hydrodynamic voltammograms observed for Pt-CeO_x/CB electrodes which were electrochemically pretreated by using various electrochemical pre-treatment conditions.



Figure 2A for SI CV curves for CO stripping experiment.

Sweep rate: 20mVsec⁻¹, Electrolyte: 0.5M H₂SO₄ aqueous solution.



Figure 2B for SI CV curves for electrochemical pre-treatment experiment observed at 30 cycle sweeps using three kinds of condition; (a) potential range: 0 to 1.0V (vs.RHE), (b) potential range: 0 to 1.3V

(vs.RHE) and (c) potential range: 0 to 1.5V (vs.RHE).

Sweep rate: 50mVsec⁻¹, Electrolyte: 0.5M H₂SO₄ aqueous solution.



Figure 3 for SI (a): Specified activity observed for Pt-CeO_x/C (\Box) and home-made Pt/C (\bullet) and (b): mass-activity observed for Pt-CeO_x/C (\Box) and home-made Pt/C (\bullet).