

Electronic Supplementary Information (ESI)

Enhanced Oxygen Reduction Reaction by Bimetallic CoPt and PdPt Nanocrystals

Bhalchandra A. Kakade^a, Hailin Wang^b, Takanori Tamaki^b, Hidenori Ohashi^b and
Takeo Yamaguchi^{*b}

^aSRM Research Institute, SRM University, Kattanakulathur, Chennai, India 603 203.

^bChemical Resources Laboratory, Tokyo Institute of Technology, R1-17, 4259

Nagatsuta, Midori-ku, Yokohama, Japan 226-8503.

Fax: (+81) 45-924-5254; Tel: (+81) 45-924-5253.

E-mail: yamag@res.titech.ac.jp

KEYWORDS: Platinum, Alloy, stripping voltammetry, ORR

BRIEFS: An improved ORR has been shown by bimetallic PdPt and CoPt nanocrystals

S1) EDS Analysis of Co₁₅Pt₈₅ Nanocrystals

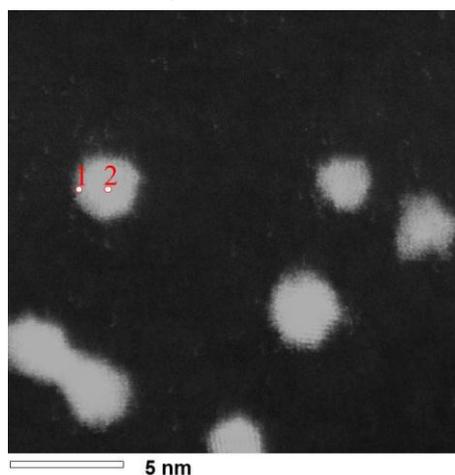


Fig. S1. HAAD-STEM image of Co₁₅Pt₈₅ nanocrystals showing points 1 and 2 selected for EDS scanning.

Table T1. Elemental composition at selected points 1 and 2, as shown in Fig. S1 and S2.

| Point | Co | Pt |
|-------|------|-------|
| 1 | 1.86 | 98.14 |
| 2 | 1.62 | 98.38 |

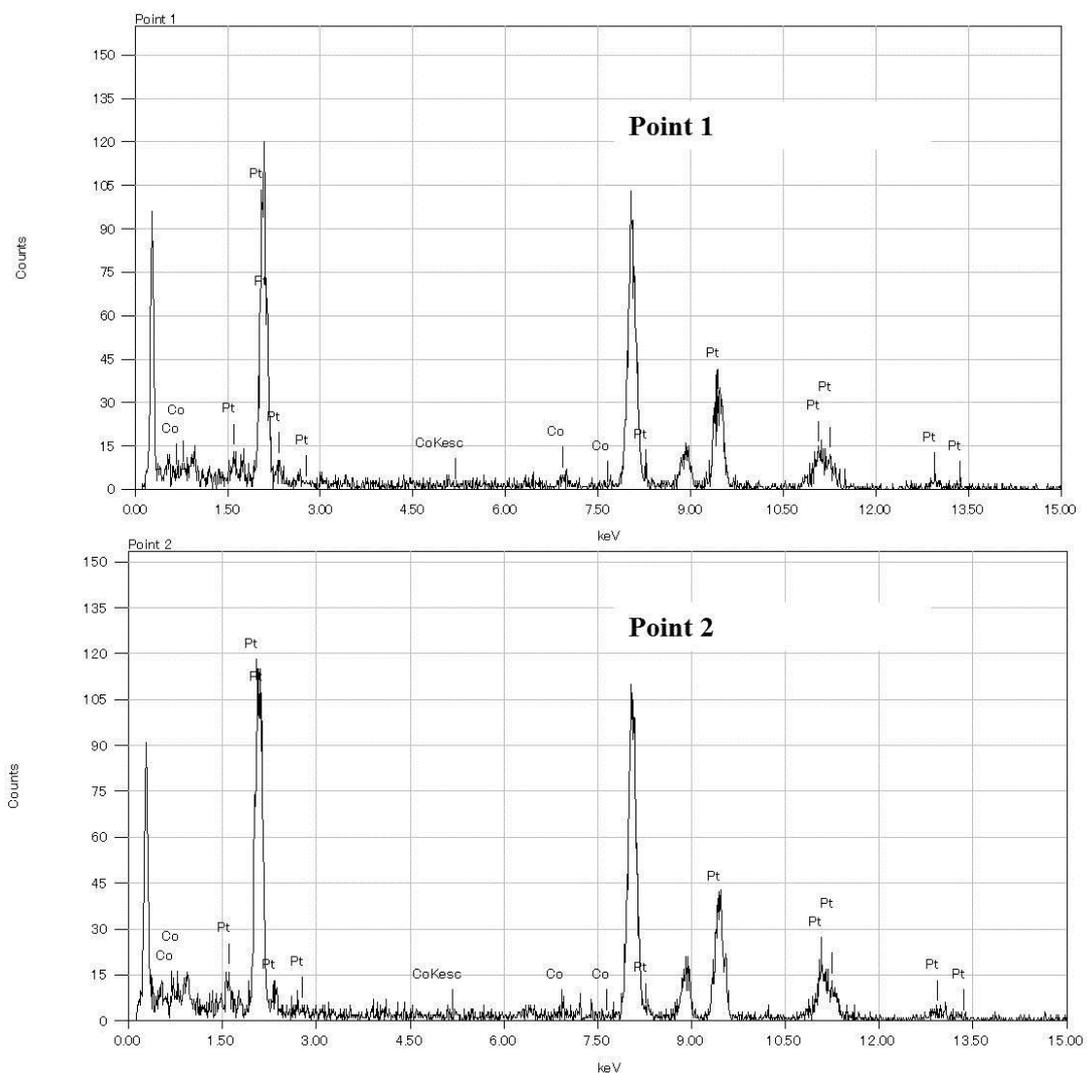


Fig. S2. EDS spectrum taken at two different positions of a single $\text{Co}_{15}\text{Pt}_{85}$ nanocrystals to evaluate/compare the elemental distribution within nanocrystal (point 1 and 2 are selected as shown in HAAD-STEM image and corresponding composition has been tabulated from EDS analysis).

S2. Catalytic Activities by ORR polarization curves

Table T2. ORR activities of the active catalysts determined from ORR curves from Figure 2.

| Catalysts | Pt loading from ICP (μg) | EC SA (m² /g) | Roughness factor (ϕ) = $A_{\text{real}}/A_{\text{geo}}$ | Area specific activity at 0.9 V ($\mu\text{A}/\text{cm}^2_{\text{Pt}}$) | Mass specific activity at 0.9 V (A/mg_{Pt}) | Area specific activity at 0.85 V ($\text{mA}/\text{cm}^2_{\text{P}}$) | Mass specific activity at 0.85 V (A/mg_{Pt}) |
|---|---|---------------------------------|---|---|--|---|---|
| Pt/C | 2.146 | 99 | 10.9 | 292 | 0.29 | 0.85 | 0.8 |
| Co₁₅Pt₈₅/C | 2.21 | 90 | 10.2 | 830 | 0.75 | 3.17 | 2.87 |
| Pd₂₂Pt₇₈/C | 1.93 | 95 | 9.36 | 455 | 0.433 | 1.435 | 1.36 |
| CoPt/C comm | 2.73 | 63 | 8.8 | 642 | 0.41 | 1.71 | 1.079 |

S3. ORR studies of Pd/C catalyst

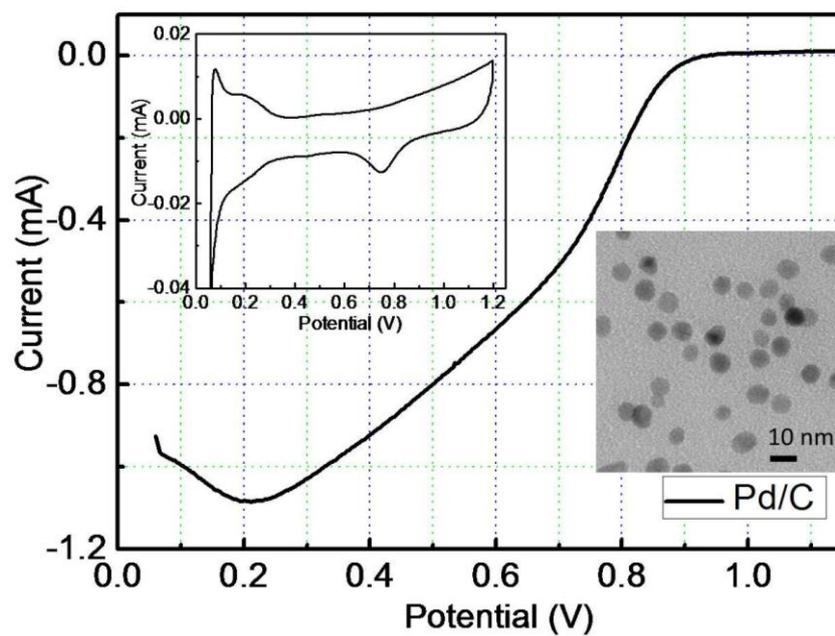


Fig. S3. ORR polarization curve for Pd/C catalyst along with CV in N_2 saturated 0.1 M $HClO_4$ solution; TEM image indicates homogeneous size distribution of Pd nanocrystals.

S4. Comparative TEM studies of CoPt/C and PtCo/C

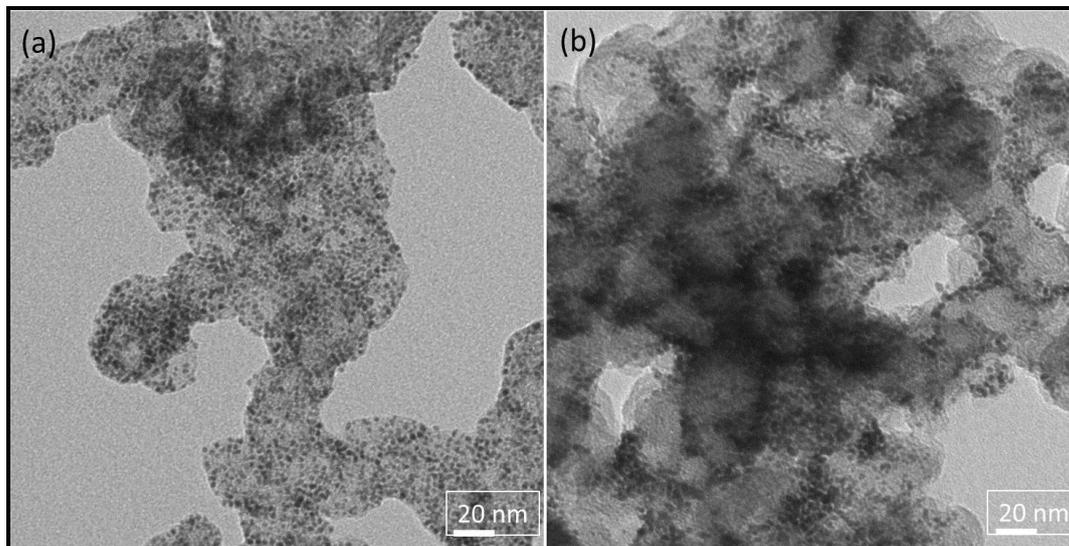


Fig. S4. Comparative TEM images of (a) Co₁₅Pt₈₅/C (b) PtCo/C revealing similar size distributions of alloy nanocrystals.