catalysts

# Supplementary Materials: Assessing the Potential of Co-Pt Bronze for Electrocatalysis in Acidic Media

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**Table S1.** Experimental set-ups for ORR test and accelerated durability test.

| Component | Detail |
|---|---|
| Cell | Three electrode cell |
| Working electrode | Catalyst deposited on Glassy carbon |
| Counter electrode | Au mesh connected with a salt bridge |
| Reference electrode | RHE |
| Electrolyte | 0.1 M $HClO_4$ (Kanto Chemical, Ultrapure) 310 mL for OER and ORR measurements<br>With 48 ppm $Cl^-$ (by addition of 35 μL of 12M HCl) for potential cycles |
| Temperature | 30 °C for OER and ORR measurement<br>60 °C for potential cycles |

**Table S2.** Experimental procedures for OER test.

| Procedure | Details |
|---|---|
| 1. Electrolyte deaeration | Ar bubbling (30 min) |
| 2. Cyclic Voltammetry | Potential cycling 0.05–1.7 V, 50 mV $s^{-1}$, 400 rpm, 5 cycles |
| 3 Potential step and holding | 0.4 V for 10s to 1.7 V for 60 s, 400 rpm |

**Table S3.** Experimental procedures for ORR test.

| Procedure | Details |
|---|---|
| 1. Electrolyte deaeration | Ar bubbling (30 min) |
| 2. Electrode cleaning | Potential cycling 0.05–1.2 V, 500 mV $s^{-1}$,100 cycles |
| 3. ECSA determination | Potential cycling 0.05–1.0 V, 50 mV $s^{-1}$, 5 cycles |
| 4. Background voltammetry | 0.05–1.0 V, 10 mV $s^{-1}$, 3 cycles |
| 5. $O_2$ saturation | $O_2$ bubbling (30 min) |
| 6. ORR measurement | 0.05–1.0 V, 10 mV $s^{-1}$, 400 rpm, 1 cycle |

**Table S4.** Experimental procedures for accelerated durability test.

| Procedure | Details |
|---|---|
| 1. ORR test | Same condition with Table S2 |
| 2. Electrolyte change | adding 12 M HCl, 35 μL |
| 3. ORR measurement | in the electrolyte containing 48 ppm $Cl^-$ |
| 4. Electrolyte deaeration | Ar bubbling (30 min) |
| 5. ECSA measurement | 0.05–1.0 V, 50 mV $s^{-1}$, 5 cycles |
| 6. Potential step cycle | at 60 °C: 0.4–1.0 V each 3 s hold, 400 rpm |
| 7. ECSA measurement | 0.05–1.0 V, 50 mV $s^{-1}$, 5 cycles after 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000 and 10,000 potential step cycles |
| 8. Electrolyte sampling | (3 mL) for Pt ion concentration analysis after 0, 100, 200, 1000, 2000 and 10,000 Potential step cycles |
| 9. ORR measurement | at 30 °C after $O_2$ bubbling (30 min) |
| 10. ECSA measurement | after Ar bubbling (30 min) |
| 11. ORR measurement | after exchanging electrolytes to one without $Cl^-$ |

**Table S5.** Pt ion concentration determination.

| Item | Detail |
|---|---|
| Apparatuses | Metrohm VA663, Metrohm IME663 |
| Electrodes | WE: hanging mercury drop, CE: Glassy carbon, RE: Ag/AgCl/3 M KCl |
| Supporting Electrolyte | 0.6 M sulfuric acid, 0.18 mM hydrazine and 6.6 mM formaldehyde mixture deaerated by nitrogen bubbling 10 min |
| Operational modes | Potential sweep mode Differential pulse mode (modulation time: 0.05 s, modulation amplitude: 0.05 V, Interval: 0.2 s, step potential: 0.004 V) |
| Procedures | Nitrogen bubbling: 10 s<br>Mercury drop refresh: 5 drops<br>Pre-condensation: at −0.7 V, stirrer 1500 rpm, 60 s<br>Potential sweep 10 s after stirrer stop: −0.7 to −1.1 V |
| Signal Peak | at −0.83 V Pt: 50, 100 and 150 ppt. See Figure S2. |
| Calibration | Pt: 50, 100 and 150 ppt. See Figure S2. |

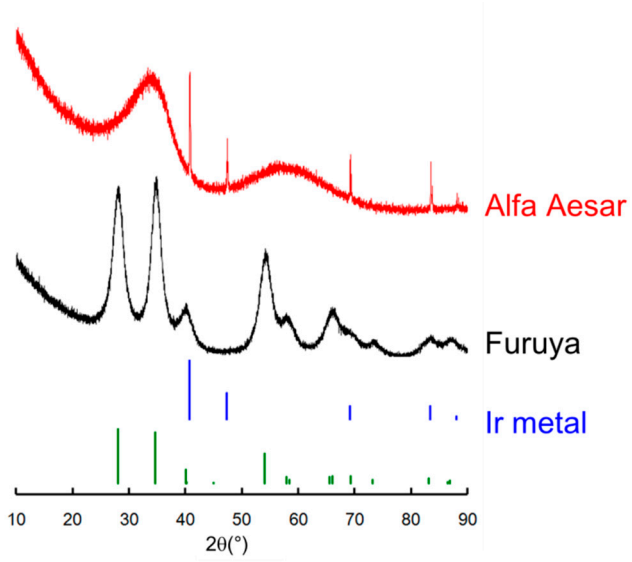


**Figure S1.** XRD patterns of two commercial iridium oxides.

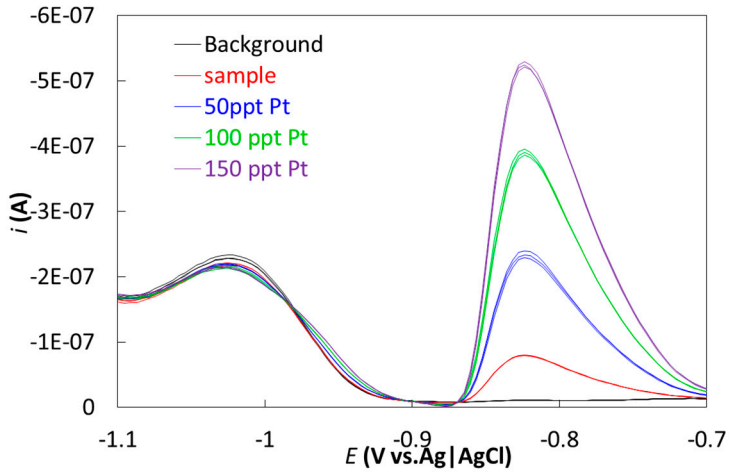


**Figure S2.** Stripping voltammogram for Pt concentration determination.

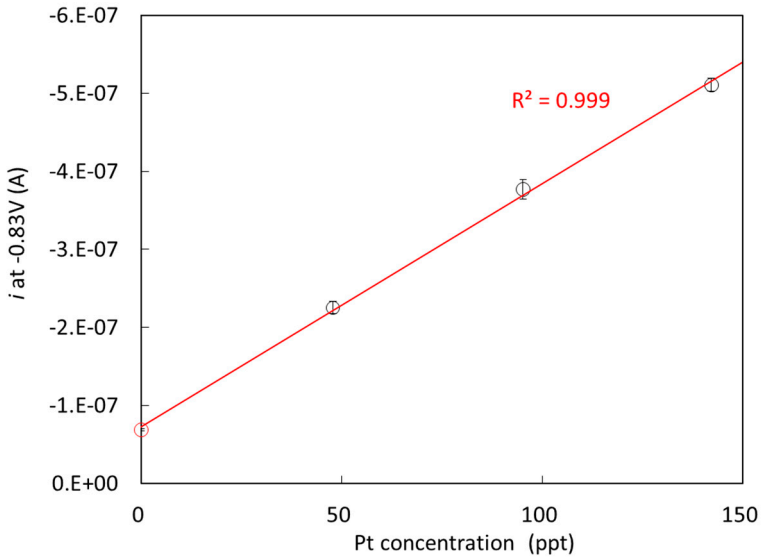


**Figure S3.** Calibration line for Pt concentration determination using the peak current at −0.83 V.

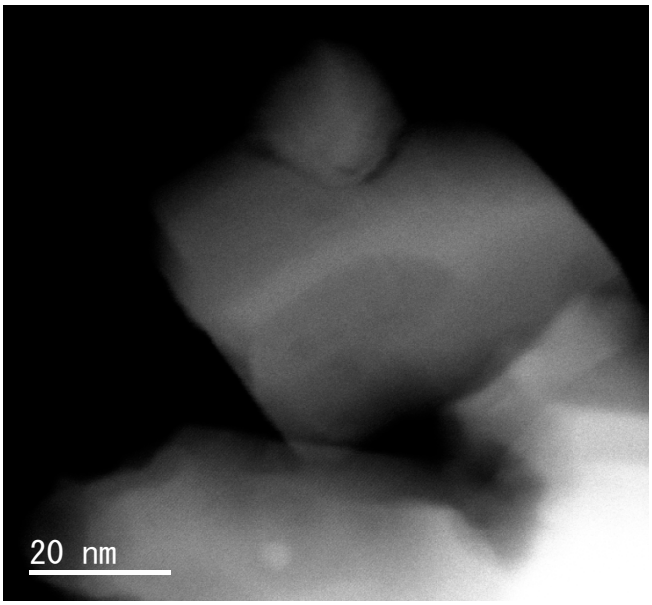


**Figure S4.** TEM image of Co-Pt bronze after ADT.