The Ethanol Oxidation Reaction Performance of Carbon-Supported PtRuRh Nanorods

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**Table 1.** SEM-EDS and XRD results of Pt, PtRu, PtRh, and PtRuRh catalysts.

| Sample  | Chemical composition (at. %) | Lattice parameter (nm) | Grain size (nm) |
|---------|------------------------------|------------------------|-----------------|
|         | Pt             | Ru | Rh |                  |                    |                  |
| Pt      | 100           | -  | -  | 0.392             | 5.3               |
| PtRu    | 90            | 10 | -  | 0.388             | 4.6               |
| PtRh    | 89            | -  | 11 | 0.388             | 4.6               |
| PtRuRh  | 85            | 5  | 15 | 0.384             | 4.8               |

**Table S1.** XPS characterization of Pt, PtRu, PtRh, and PtRuRh.

| Sample  | Surface composition (at. %) |                  |                  |
|---------|-----------------------------|------------------|------------------|
|         | Pt             | PtOx | Ru | RuOx | Rh | RhOx | OCS |
| Pt      | 74.8           | 25.2 | -  | -    | -  | -    | 25.2|
| PtRu    | 63.6           | 35.2 | 1.1| 0.1  | -  | -    | 35.3|
| PtRh    | 62.6           | 10.2 | -  | -    | 15.1| 12.2 | 22.4|
| PtRuRh  | 55.1           | 25.5 | 0.1| 0.4  | 8.9 | 10.0 | 35.5|

**Table S3.** CO-stripping results for Pt, PtRu, PtRh, and PtRuRh.

| Sample  | Onset potential (V) | ECSAco (m²/g(Pt)) |
|---------|---------------------|-------------------|
| Pt      | 0.37                | 44.3              |
| PtRu    | 0.23                | 92.6              |
| PtRh    | 0.32                | 121.6             |
| PtRuRh  | 0.29                | 157.0             |
Table S4. Comparison of EOR activity between PtRuRh and other PtRu and PtRh based ternary catalysts taken from literature.

| Samples       | Electrolyte                   | Onset potential (V) | Specific Activity (mA/cm²) | Ref.                                      |
|---------------|-------------------------------|---------------------|----------------------------|-------------------------------------------|
| MoPtRu        | 1M EtOH + 0.5 M H₂SO₄        | 0.30                | SA₀.₆ = 0.08                | Int. J. Hydrogen Energy, 2012, 37, 7131-7140 |
| PtRhSn        | 0.5 M EtOH + 0.5 M H₂SO₄     | 0.29                | SA₀.₆ = 1.78                | ACS. Catal., 2014, 4, 1859                |
| PtSnRu        | 1 M EtOH + 0.05 M H₂SO₄      | 0.24                | SA₀.₄₅ = 0.01               | J. Power Sources, 2015, 284, 623          |
| PtRhSn/C      | 0.5 M EtOH + 0.1 M HClO₄     | 0.35                | SA₀.₄₅ =0.187               | ChemElectroChem, 2015, 19, 903            |
| Pt₃RhSn       | 0.5 M EtOH + 0.1 M HClO₄     | 0.29                | SA₀.₅₅ = 0.19               | J. Mater. Chem. A, 2018, 6, 11270        |
| PtRuRh        | 1M EtOH + 0.5 M H₂SO₄        | 0.30                | SA₀.₆ = 0.38                | This study                               |
Figure S1. The XRD characterization of Pt, PtRu, PtRh, and PtRuRh.