

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	PtO _x	Ru	RuO _x	Rh	RhO _x	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)	ECSA _{CO} (m ² /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/cm ²)	Ref.
MoPtRu	1M EtOH + 0.5 M H ₂ SO ₄	0.30	SA _{0.6} = 0.08	Int. J. Hydrogen Energy, 2012, 37, 7131-7140
PtRhSn	0.5 M EtOH + 0.5 M H ₂ SO ₄	0.29	SA _{0.6} = 1.78	ACS. Catal., 2014, 4, 1859
PtSnRu	1 M EtOH + 0.05 M H ₂ SO ₄	0.24	SA _{0.45} = 0.01	J. Power Sources, 2015, 284, 623
PtRhSn/C	0.5 M EtOH + 0.1 M HClO ₄	0.35	SA _{0.45} = 0.187	ChemElectroChem, 2015, 19, 903
Pt ₃ RhSn	0.5 M EtOH + 0.1 M HClO ₄	0.29	SA _{0.55} = 0.19	J. Mater. Chem. A, 2018, 6, 11270
PtRuRh	1M EtOH + 0.5 M H ₂ SO ₄	0.30	SA _{0.6} = 0.38	This study

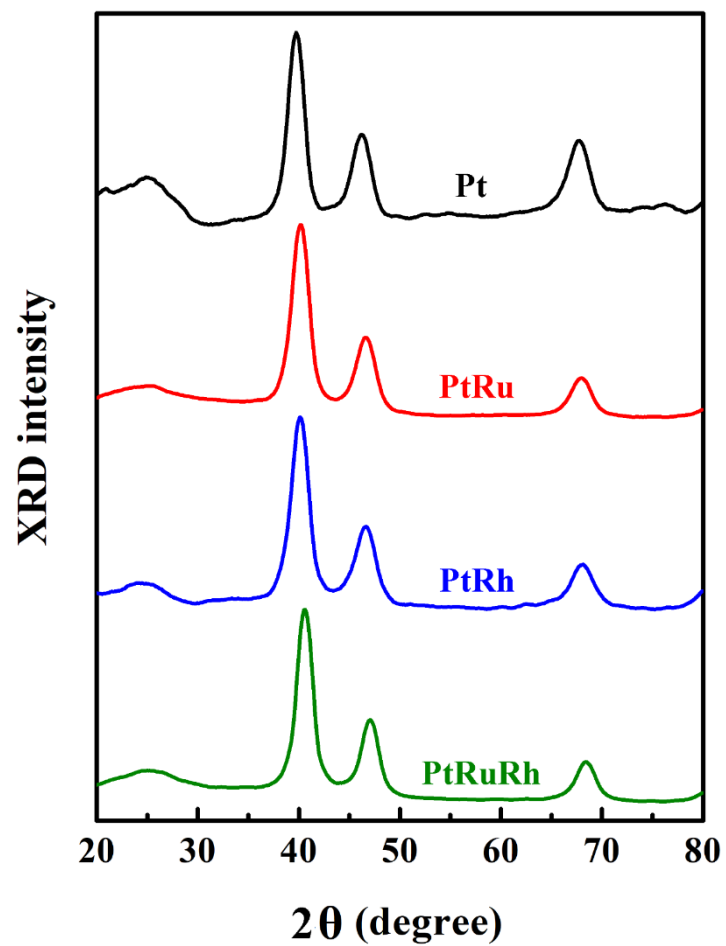


Figure S1. The XRD characterization of Pt, PtRu, PtRh, and PtRuRh.