

Electronic Supplementary Information

for

High-efficiency oxidative esterification of furfural to methylfuroate over Au/Al₂O₃ catalyst in base-free medium

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Table S1 Some typical reports of catalytic selective oxidation of furfural with base additive.

Entry	Catalyst	Condition	Furfural Conversion (%)	MF Selectivity (%)	Ref.
1	1%Au/TiO ₂ + CH ₃ ONa	Catalyst (0.25 g), furfural (4 mmol, 4 wt%), methanol (12.7 mL), molar ratio Au/furfural/methanol = 1/300/23,000, 8% CH ₃ ONa relative to furfural, 22 °C, 0.1 MPa O ₂ , 10–12 h.	~100	~100	[8]
2	5%Au/ FH + K ₂ CO ₃	Catalyst (0.05 g), furfural (2.1 mmol, 1 wt%), methanol (15 mL), K ₂ CO ₃ (0.05 g), molar ratio Au/furfural/methanol = 1/164/29,200, 140 °C, 0.3 MPa O ₂ , 4 h.	93	99	[9]
3	4.7%Au@U iO-66+ K ₂ CO ₃	Catalyst (0.025 g), furfural (1.0 mmol, 0.8 wt%), methanol (15 mL), K ₂ CO ₃ (0.025g), molar ratio Au/furfural/methanol = 1/173/62,000, 140 °C, 0.3 MPa O ₂ , 4 h.	~100	~100	[10]

Table S2 Some typical reports of catalytic selective oxidation of furfural without base additive.

Entry	Catalyst	Condition	Furfural Conversion (%)	MF Selectivity (%)	Ref.
1	1.5%Au/ZrO ₂	Catalyst (0.1 g), furfural (3.6 mmol, 3 wt%), methanol (150 mL), molar ratio Au/furfural/methanol = 1/500/5 × 10 ⁵ , 120 °C, 0.6 MPa O ₂ , 3 h, 1000 rpm.	100	98	[11]
2	1.0%Au/ZrO ₂	Catalyst (0.1 g), furfural (3.6 mmol, 3 wt%), methanol (150 mL), molar ratio Au/furfural/methanol = 1/500/5 × 10 ⁵ , 120 °C, 0.6 MPa O ₂ , 1.5 h, 1000 rpm.	82	92	[12]
3	1.5%Au/CeO ₂	Catalyst (0.1 g), furfural (3.6 mmol, 3 wt%), methanol (150 mL), molar ratio Au/furfural/methanol = 1/500/5 × 10 ⁵ , 120 °C, 0.6 MPa O ₂ , 1.5 h, 1000 rpm.	74	100	[13]
4	5%Au/CMK-3	Catalyst (0.05 g), furfural (3.6 mmol, 2 wt%), methanol (20 mL), molar ratio Au/furfural/methanol = 1/280/38,800, 120 °C, 1.5 MPa O ₂ , 3 h.	99.7	99.6	[14]
5	2%Au/MgO	Catalyst (0.1 g), furfural (0.05 mmol, 0.03 wt%), methanol (20 mL), molar ratio Au/furfural/methanol=1/50/50,000, 110 °C, 0.6 MPa O ₂ , 2 h, 600 rpm.	100	95	[15]
	2%Au/CaO		82	67	
	2%Au/SrO		62	45	
	2%Au/BaO		40	38	

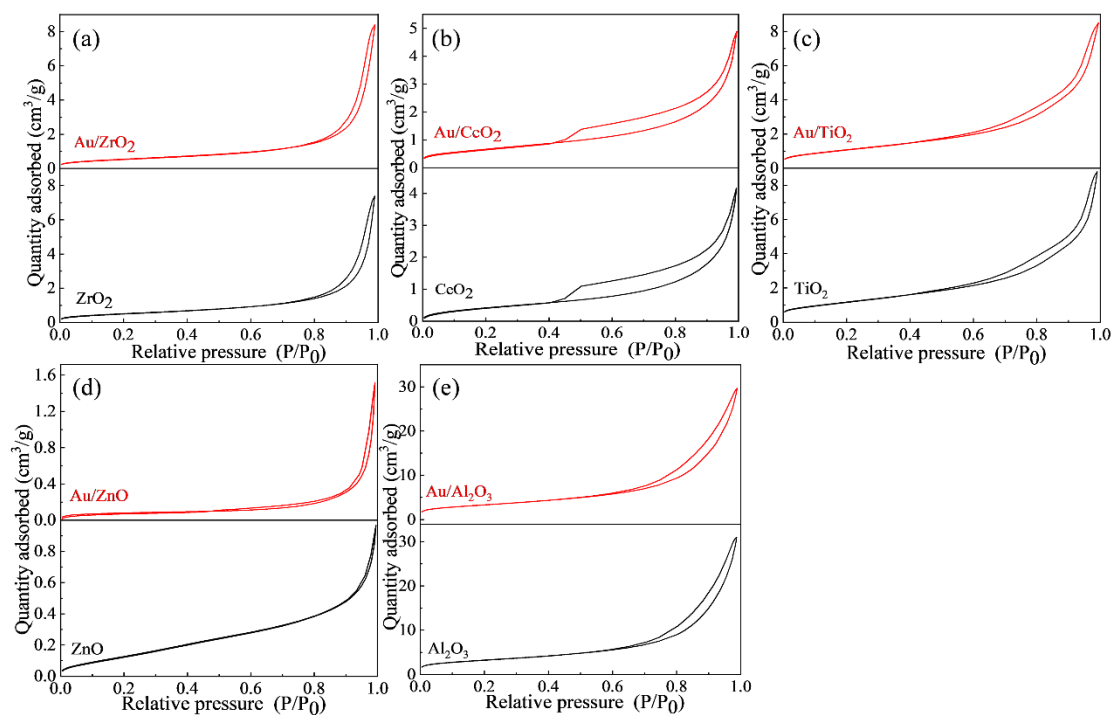


Fig.S1 N₂ physisorption isotherms of (a) ZrO₂ and Au/ZrO₂, (b) CeO₂ and Au/CeO₂, (c) TiO₂ and Au/TiO₂, (d) ZnO and Au/ZnO, (e) Al₂O₃ and Au/Al₂O₃.

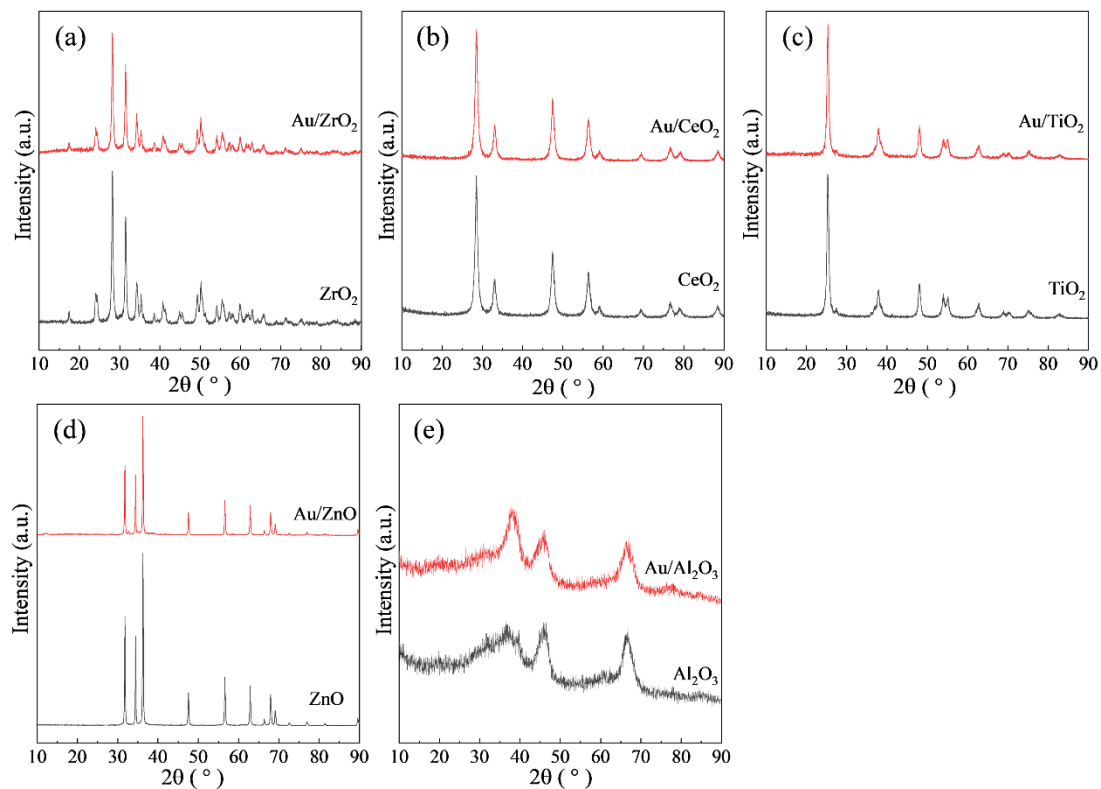


Fig.S2 XRD patterns of (a) ZrO₂ and Au/ZrO₂, (b) CeO₂ and Au/CeO₂, (c) TiO₂ and Au/TiO₂, (d) ZnO and Au/ZnO, (e) Al₂O₃ and Au/Al₂O₃.

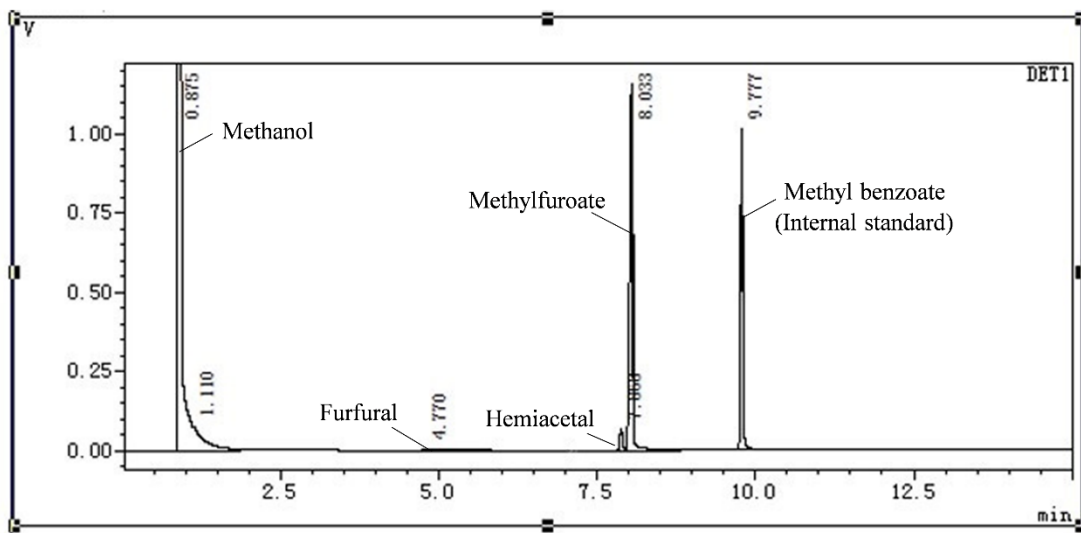


Fig.S3 GC Chromatogram of products of a typical reaction. Reaction conditions: furfural (1 g), catalyst (0.2 g), methanol (9 g), O₂ (1.0 MPa), 120°C and 1 h.

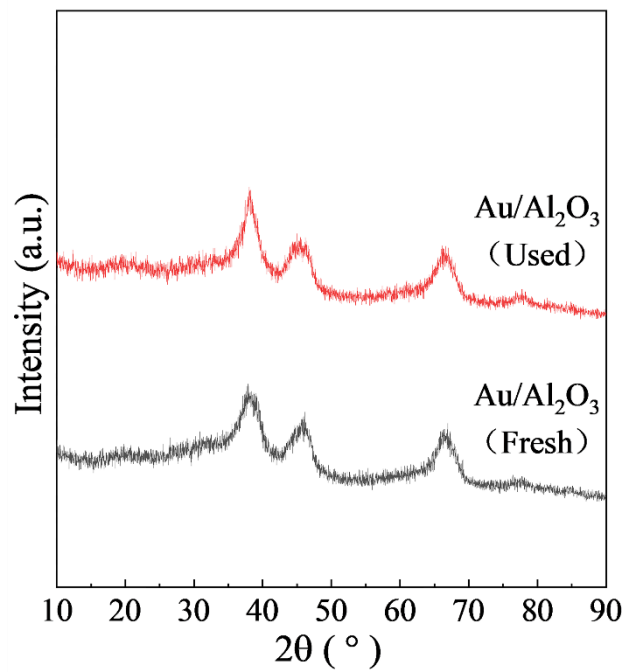


Fig.S4 XRD patterns of Au/Al₂O₃(fresh) and Au/Al₂O₃(used) catalysts.