

Table S1 Summary of the catalytic data of Ru-based catalysts used in m-cresol hydrodeoxygenation reaction.

Entry	Catalyst	The flow of H ₂ (mL/min)	Conversion (%)	Selectivity (%)		
				Toluene	methylcyclohexane	oxygenated compounds ^e
1	5% Ru/TiO ₂	5	0.3	60	20	20
2	5% Ru/Al ₂ O ₃	5	16	76	17	7
3	5% Ru/Nb ₂ O ₅	5	88	96	3	1
4	5% Ru/CeO ₂	5	15	30	10	60
5	5% Ru/ZrO ₂	5	40	52	8	40
6	5% Ru/TiO ₂ ^a	5	25	42	24	34
7	5% Ru/TiO ₂ ^b	5	1	75	20	5
8	5% Ru/TiO ₂ -3.5%P ^c	5	95	95	5	0
9	5% Ru/TiO ₂ -3.5%P ^d	5	23	80	16	4

Reaction conditions: WHSV = 0.62 h⁻¹ (m-cresol), H₂ (0.1 MPa), 300 °C.

a: 5% Ru/TiO₂ was reduced by NaBH₄;

b: 5% Ru/TiO₂ reduced by NaBH₄ and further reduced under H₂ atmosphere at 350 °C;

c: The reactant was changed to 10 wt% m-cresol in N-decane with the WHSV = 0.06 h⁻¹;

d: The P was modified after 5%Ru/TiO₂ was reduced at 350 °C;

e: Methylcyclohexanone and methylcyclohexanol were summed as oxygenated compounds.

Table S2 The exact ratio between P and Ti.

Sample	The mass fraction of P (wt%)
TiO ₂	0
P/TiO ₂ =0.5	2.6
P/TiO ₂ =0.75	2.9
P/TiO ₂ =1	3.5
P/TiO ₂ =1.5	4.8

Table S3 The exact mass fraction of Ru on Ru-based catalysts

Sample	The mass fraction of Ru (wt%)
5%Ru/TiO ₂	4.92
5%Ru/TiO ₂ -2.6%P	4.89
5%Ru/TiO ₂ -3.5%P	4.95
5%Ru/TiO ₂ -4.8%P	5.01

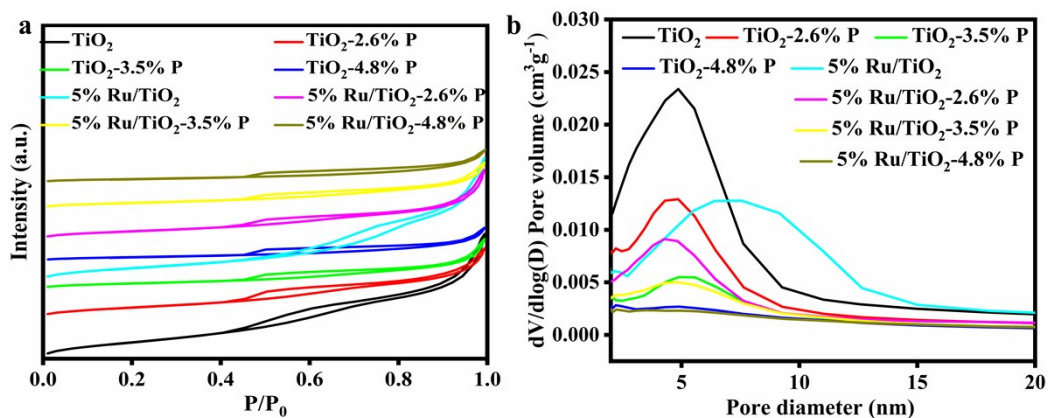


Figure S1 The results of (a) the N₂-sorption and (b) the pore structure of TiO₂ and the modified TiO₂.

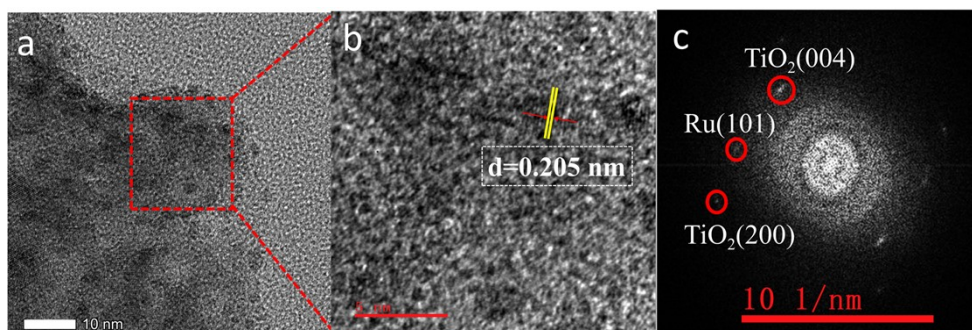


Figure S2 (a) TEM image of 5%Ru/TiO₂-3.5%P; (b) the partial enlargement of image (a); (c) the FFT image of image (a).

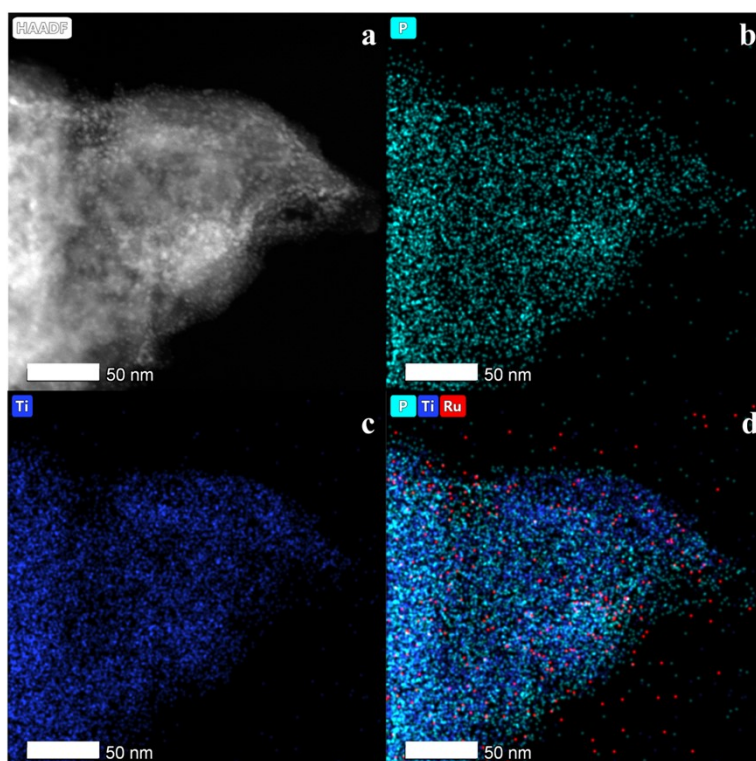


Figure S3 The HAADF images of 5%Ru/TiO₂-3.5%P

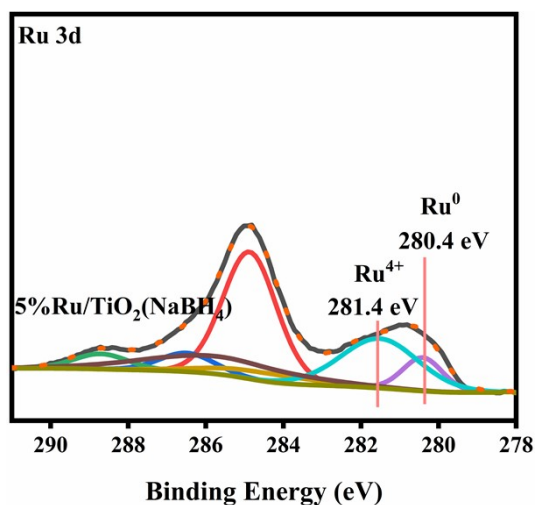


Figure S4 The XPS patterns of 5%Ru/TiO₂(NaBH₄).

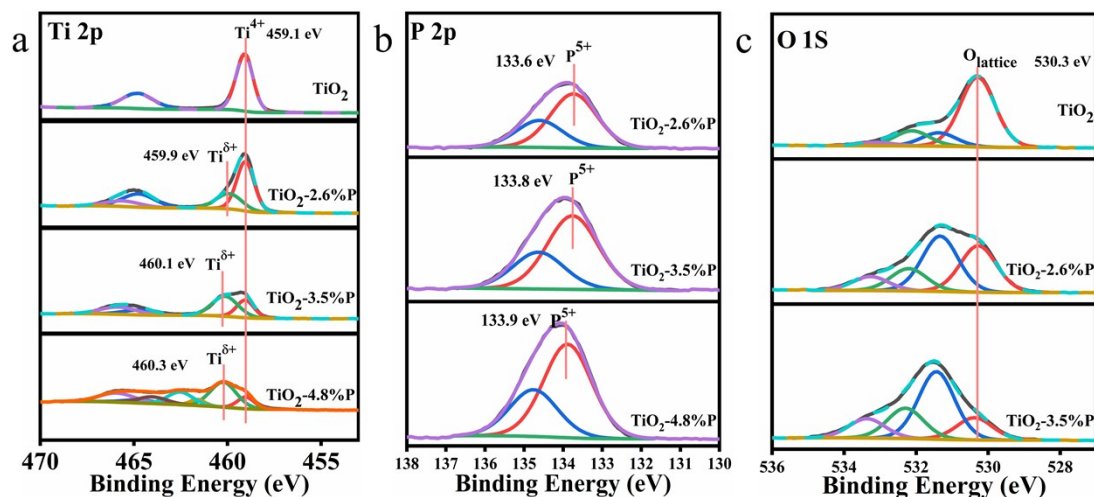


Figure S5 The XPS patterns of TiO₂(P=n) (a) Ti 2p; (b) P 2p and (c) O 1s.

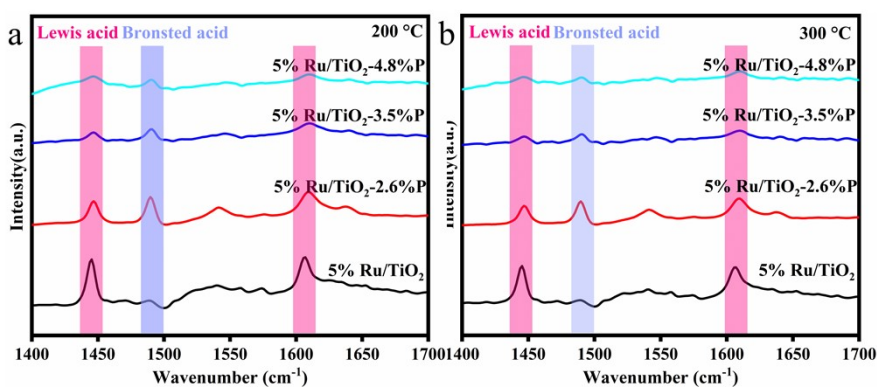


Figure S6 FTIR spectra of pyridine adsorption on Ru-based catalysts at 200 °C (a) and 300 °C (b).