Supporting Information

Highly dispersed Ru immobilized on Ni-modified Al_2O_3 for selective hydrogenation of bisphenol A to hydrogenated bisphenol A

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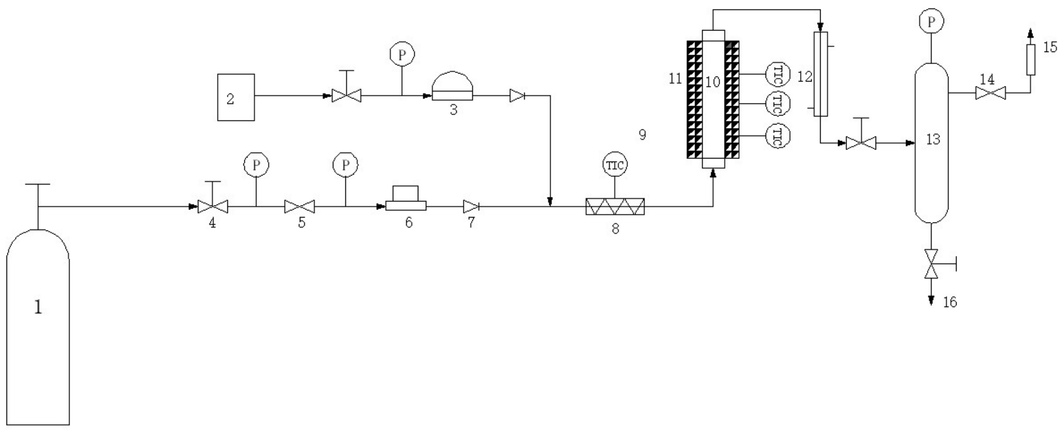

Fig. S1 Hydrogenation device of BPA.

1-N_2 cylinder, 2-Raw material storage tank, 3-Liquid flow pump, 4-Stop valve, 5-Reducing valve, 6-Wet gas volume flowmeter, 7-Check valve, 8-Mixing preheater, 9-Thermoelectric couple, 10-Reactor, 11-Heating jacket, 12-Condenser, 13-Gas-liquid separator, 14-Stand-by valve, 15-Wet gas flowmeter, and 16-Sampling hatch.

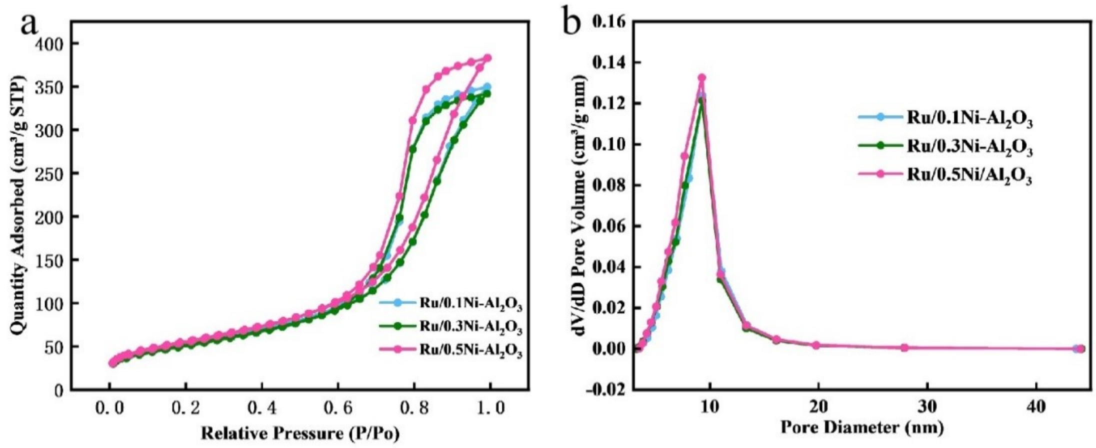

Fig. S2 N_2 adsorption-desorption isotherms and corresponding pore size distributions of catalysts with varied Ni doping amounts.

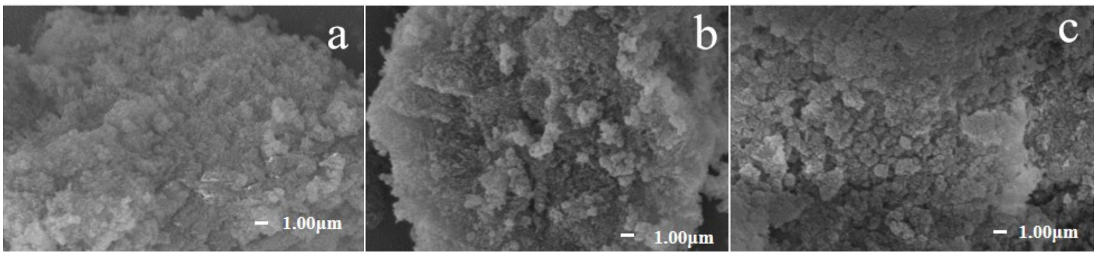

Fig. S3 FE-SEM images of (a) Al_2O_3, (b) Ru/Al_2O_3, and (c) $Ru/0.1Ni-Al_2O_3$.

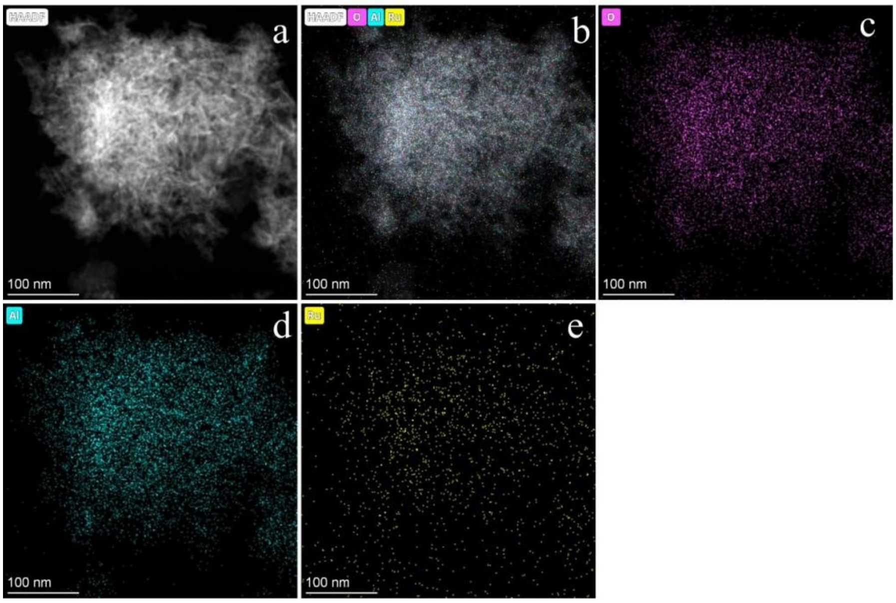

Fig. S4 (a) HAADF-STEM image and (b-e) elemental mappings of Ru/Al_2O_3.

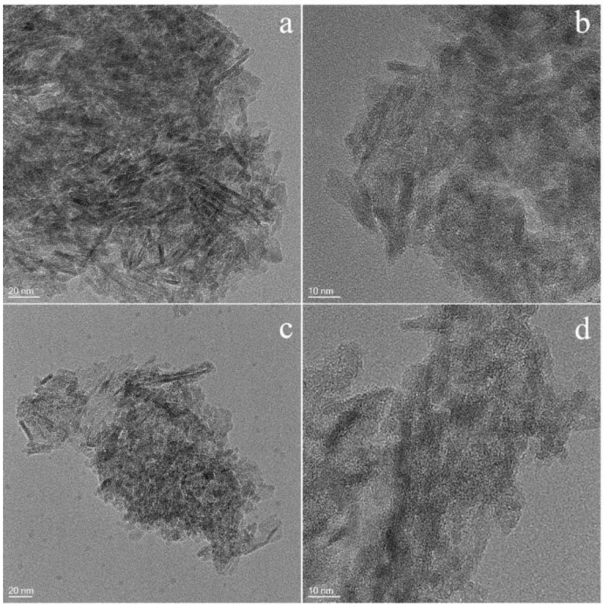

Fig. S5 HRTEM image of $Ru/0.1Ni\text{-}Al_2O_3$ (a,b) and Ru/Al_2O_3 (c,d).

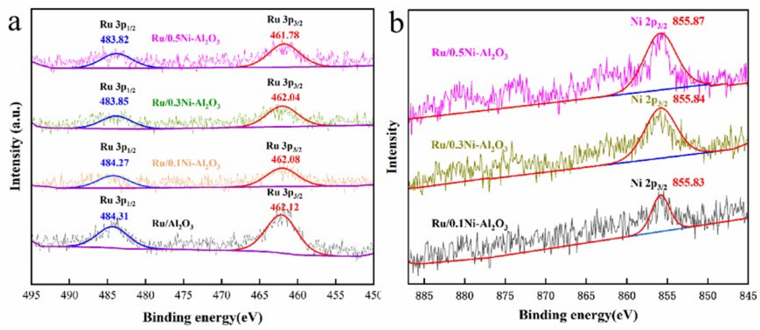

Fig. S6 High-resolution Ru 3p XPS spectra (a) and Ni 2p XPS spectra (b).

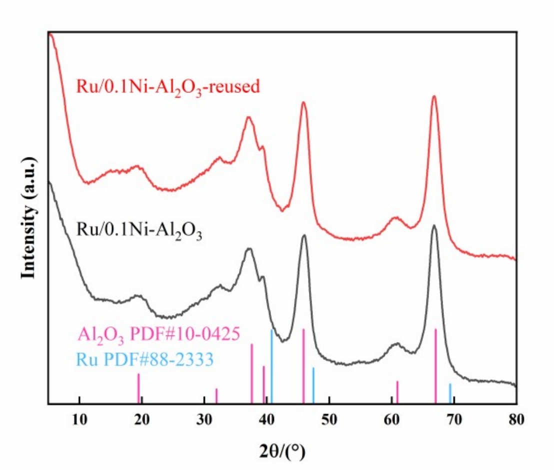

Fig. S7 XRD patterns of the catalyst after stability testing and the fresh one.

Table S1 Results of ICP.

Catalyst	Ru loading (wt.%)		Ni loading (wt.%)	
	Theoretical	Measured	Theoretical	Measured
Ru/Al_2O_3	0.50	0.48	/	/
$Ru/0.1Ni\text{-}Al_2O_3$	0.50	0.43	0.10	0.09
$Ru/0.3Ni\text{-}Al_2O_3$	0.50	0.42	0.30	0.25
$Ru/0.5Ni\text{-}Al_2O_3$	0.50	0.45	0.50	0.48
$Ru/0.1Ni\text{-}Al_2O_3$-reused	0.50	0.41	0.10	0.08

Table S2 Textural parameters of different samples.

Catalyst	Specific surface area ($m^2\ g^{-1}$)	Pore volume ($mL\ g^{-1}$)	Pore diameter (nm)
Al_2O_3	215.91	0.587	10.38
Ru/Al_2O_3	210.83	0.587	10.91
$Ru/0.1Ni\text{-}Al_2O_3$	192.08	0.545	10.64
$Ru/0.3Ni\text{-}Al_2O_3$	190.24	0.533	10.69
$Ru/0.5Ni\text{-}Al_2O_3$	201.18	0.597	10.91
$Ru/0.1Ni\text{-}Al_2O_3$-reused	193.81	0.548	9.95

Table S3 Comparison of the catalytic activity of $Ru/0.1Ni\text{-}Al_2O_3$ presented in this work with the recently reported heterogeneous catalysts for BPA hydrogenation to HBPA.

Catalyst	BPA conversion (%)	HBPA selectivity (%)	Ref.
$Ru/0.1Ni\text{-}Al_2O_3$	100	96.4	This work
Ni/Al_2O_3	95.2	48.2	This work
Ru/Al_2O_3	100	94.5	This work
Pd/Al_2O_3	86.5	56.8	This work
Pt/Al_2O_3	88.4	56.9	This work
$0.1Pd/Mg_{0.2}Al_{0.8}O_{2.8}$	99.2	98.2	S1
$35Ni/4MoO_3\text{-}30ZrO_2\text{-}31Al_2O_3$	97	94.8	S2
Rainey nickel	100	95.1	S3
CaO, MgO/Raney-nickel	100	94.1	S4

Reaction conditions: 20 ml catalyst, the catalyst of Ni/Al_2O_3, Ru/Al_2O_3, Pd/Al_2O_3 and Pt/Al_2O_3 of this work 2 to 5 was 0.1 wt.%，6 MPa H_2, 130 °C, 0.3 h^{-1} LHSV, and 1500:1 hydrogen-oil volume ratio.

Supplementary references

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