Electronic Supplementary Material (ESI) for RSC Advances.

Oxidation modification of Ru-based catalyst for acetylene hydrochlorination

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Figure S7. TEM images of the fresh and used catalysts: (a) Fresh Ru/AC, (b) Used Ru/AC, (c) Fresh Ru/AC-O, (d) Used Ru/AC-O, (e) Fresh (Ru/AC)-O, (f) Used (Ru/AC)-O, (g) Fresh Ru-O/AC-O, (h) Used Ru-O/AC-O.

Table S1 The catalytic performance of some potential non-mercury catalysts recently reported in the literatures.

Catalyst	Composition of catalysts	Reaction conditions	Initial catalytic activity [a]	Deactivation rate (% h^{-1}) [b]
Mo_2N/AC [1]	1.5 wt% MoN	T = 180 °C. GHSV(C_2H_2) = 30 h^{-1}, V_{HCl}/V_{C2H2} = 1.15	X_A = 80.0%, Svc_M > 90.0%	4.28
Au-Bi/C [2]	0.30 wt% Au, n(Bi)/n(Au) = 3	T = 180 °C. GHSV(C_2H_2) = 600 h^{-1}, V_{HCl}/V_{C2H2} = 1.1	X_A = 87.0%, Svc_M > 99.0%	0.500
$PdCl_2$-KCl-$LaCl_3$/C [3]	0.9 wt% Pd, 0.2 wt% KCl, 0.2 wt% $LaCl_3$	T = 120-180 °C. GHSV(C_2H_2) = 120 h^{-1}, V_{HCl}/V_{C2H2} = 1.15	X_A = 98.0%, Svc_M > 99.5%	10.500
Z4M1 [4]	1.5 at% N	T = 180 °C. GHSV(C_2H_2) = 50 h^{-1}, V_{HCl}/V_{C2H2} = 1.15	X_A = 60.0%, Svc_M > 90.0%	0.300
Ru-in-CNT [5]	1 wt% Ru	T = 170 °C. GHSV(C_2H_2) = 90 h^{-1}, V_{HCl}/V_{C2H2} = 1.1	X_A = 99.8%, Svc_M > 99.0%	0.480
Ru-O/AC-O	1 wt% Ru	T = 180 °C. GHSV(C_2H_2) = 180 h^{-1}, V_{HCl}/V_{C2H2} = 1.15	X_A = 99.6%, Svc_M > 99.9%	0.275

[a] X_A represents the initial conversion of acetylene and S_{VCM} represents the selectivity to VCM of the catalyst.

[b] Deactivation rate was defined as (the initial maximum C_2H_2 conversion – the final C_2H_2 conversion)/(deactivation period, h)

25 **Table S2** The relative content of the elements in the catalysts, determined by XPS spectra.

Catalysts	Ru (wt%)	O (wt%)	C (wt%)	Others (wt%)
Fresh AC	---	13.42	85.75	0.83
Used AC	---	5.68	93.53	0.79
Fresh AC-O	---	22.33	77.05	0.62
Used AC-O	---	15.05	84.37	0.58
Fresh Ru/AC	0.98	11.57	86.98	0.47
Used Ru/AC	0.92	6.46	92.23	0.39
Fresh Ru/AC-O	0.96	18.43	80.02	0.59
Used Ru/AC-O	0.91	13.51	85.06	0.52
Fresh (Ru/AC)-O	0.95	19.32	79.01	0.72
Used (Ru/AC)-O	0.93	14.85	83.56	0.66
Fresh Ru-O/AC-O	0.97	20.29	78.28	0.46
Used Ru-O/AC-O	0.95	17.58	81.09	0.38

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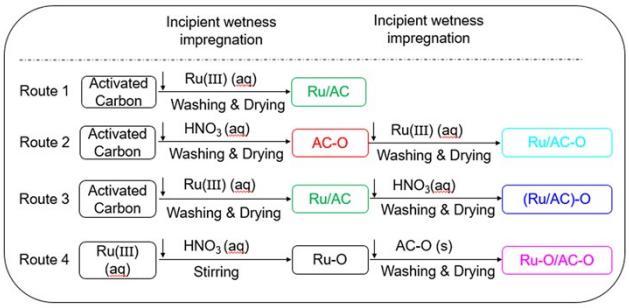


Figure S1. The schematic diagram of four different routes to synthesize Ru-based catalysts.

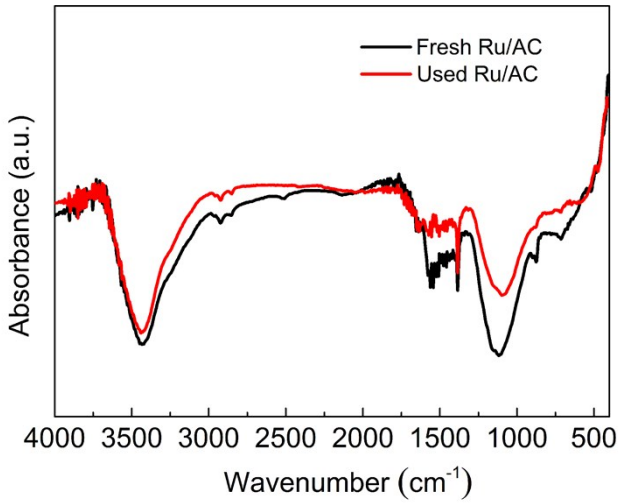


Figure S2. FT-IR spectra of the fresh and used Ru/AC catalysts.

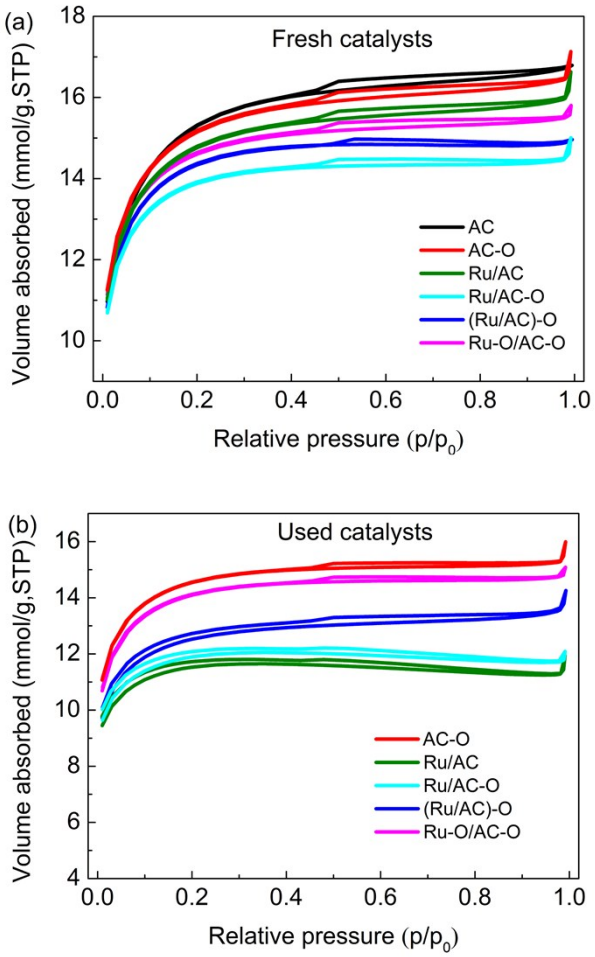


Figure S3. Nitrogen adsorption-desorption isotherms of the fresh (a) catalysts and used (b) catalysts.

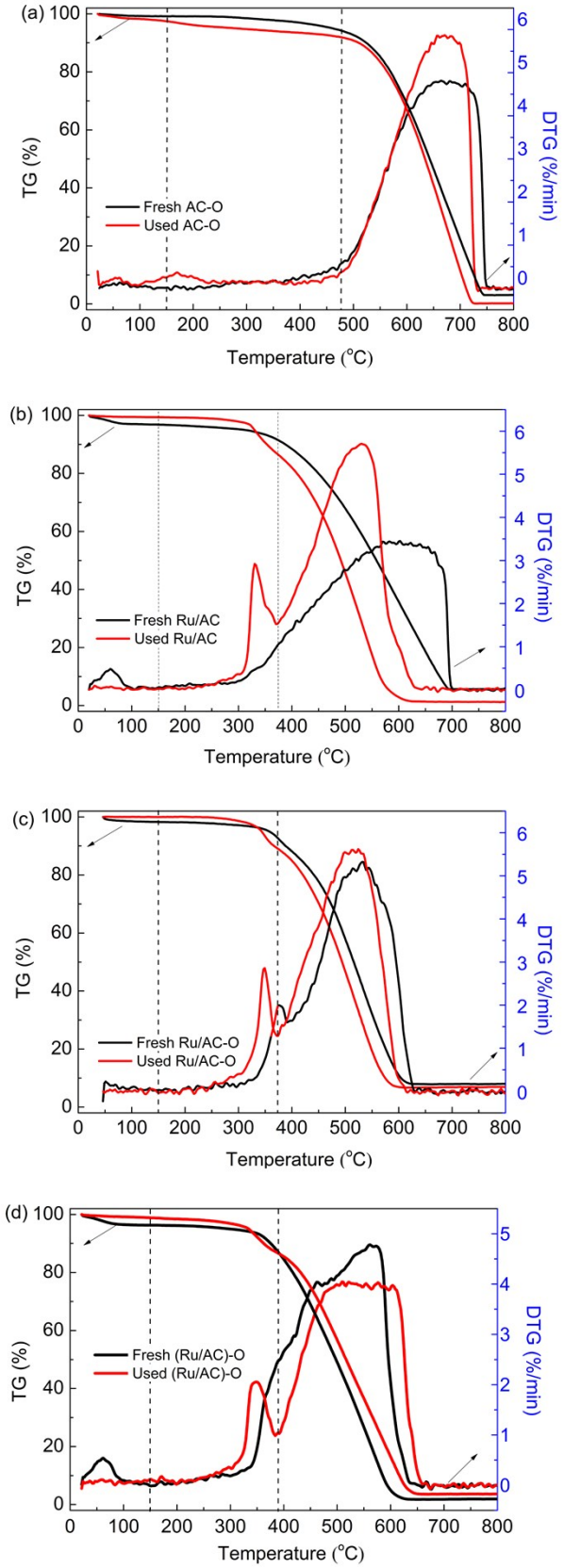


Figure S4. TG curves of fresh and used catalysts recorded in air atmosphere.

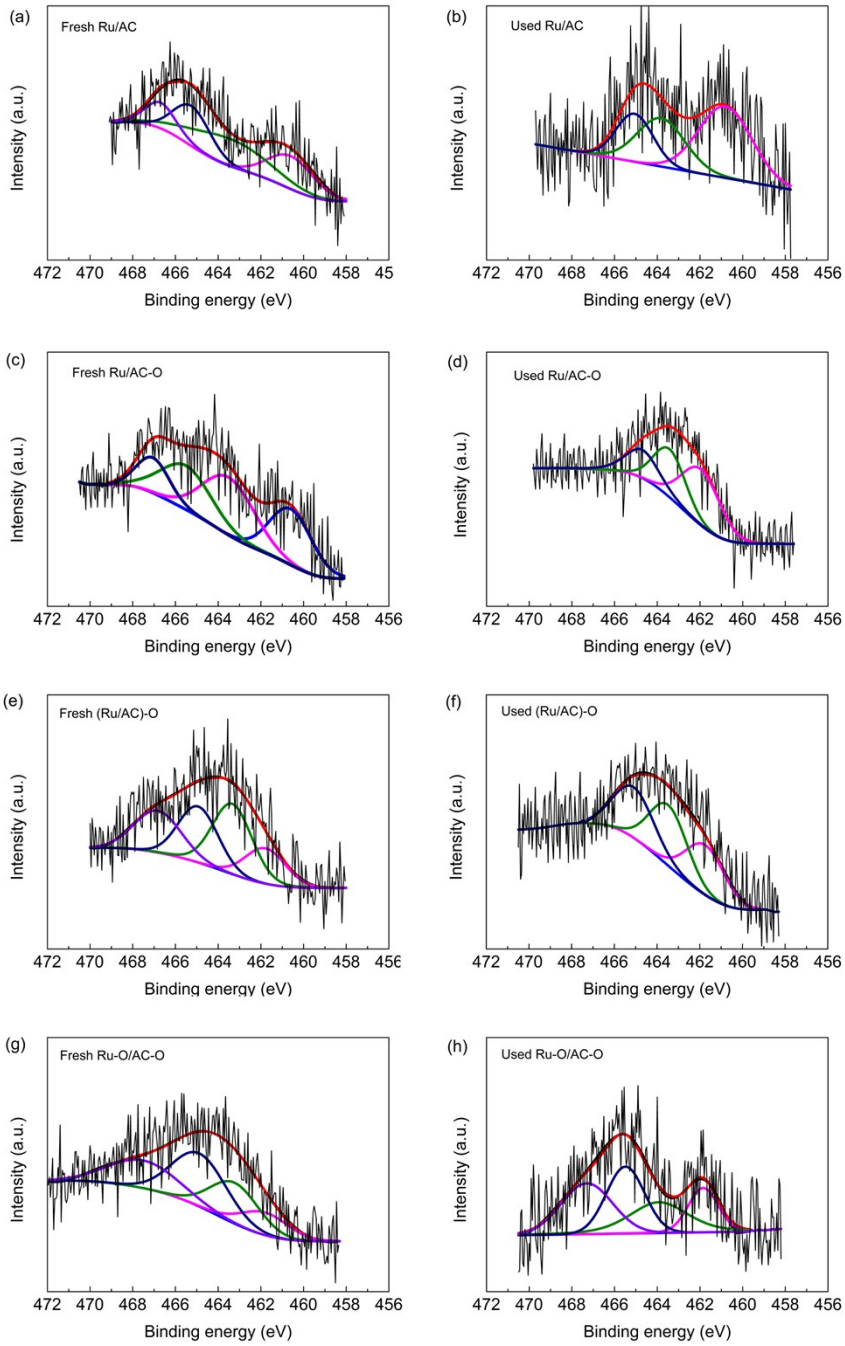


Figure S5. High-resolution XPS spectra of Ru 3p for the fresh and used Ru-based catalysts.

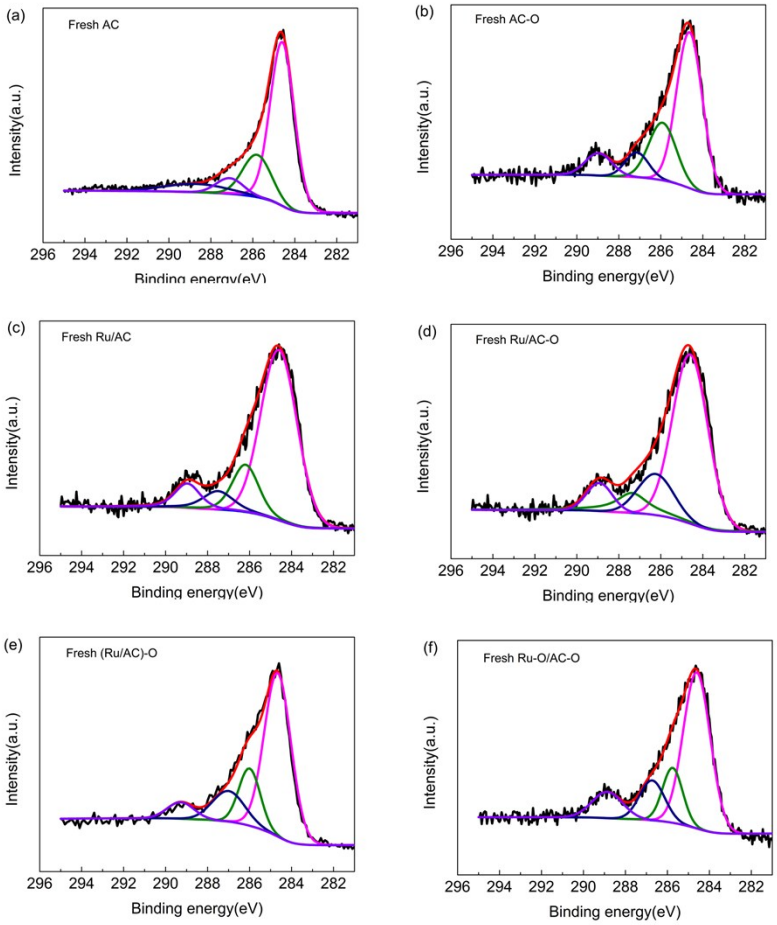
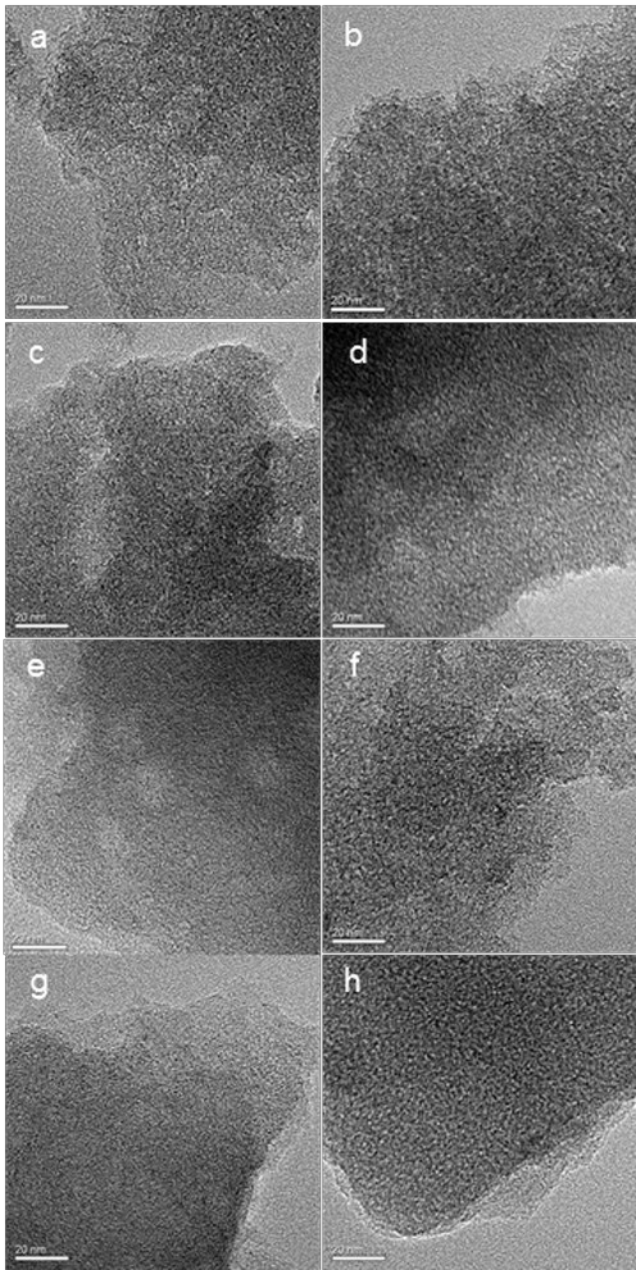


Figure S6. XPS spectra of C 1s for the fresh catalysts.



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