Supporting information

Effect of Acidity and Ruthenium Species on Catalytic Performance of Ruthenium Catalysts for Acetylene Hydrochlorination

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The AC was put in 1mol/L HCl solution and impregnation for 24 hours and then dried at 120 °C for 10 hours. The obtained product was donated as AC-HCl and was used for XPS characterization. From Figure S5, the peak at 200.2 eV is assigned to the C-Cl, which may be formed by the chemical adsorption of Cl^- anions produced by the HCl solution.

$RuCl_3$/AC-A: the active carbon support is treated with ammonia for 12 hours and then impregnated with ruthenium trichloride for 24 hours at room temperature, and then it was dried at 120 °C for 10 hours.

Table S1 Information on ruthenium catalysts is available in the literatures

Catalysts	Ru loading (wt%)	Temp.(°C)	GHSV (C_2H_2) (h^{-1})	Conv.	V_{HCl}/V_{C2H2}	References
$RuCl_3$-A/AC	1	180	100	99.5	1.05	Present study
1%Ru@15%TPPB/AC	1	170	180	99.7	1.15	Shang S, Zhao W, Wang Y, et al. ACS Catal. 2017, 7, 3510-3520
1%Ru–O/AC–O	1	180	180	93	1.15	Man B, Zhang H, Zhang J, et al. RSC Adv, 2017, 7,23742-23750
1%Ru_5Cl_7/AC	1	180	180	89	1.15	Man B, Zhang H, Zhang C, et al. New J. Chem., 2017, 41, 14675-14682
$(NH_4)_2RuCl_6$/AC	1	170	180	89	1.1	Han,Y et al. Catalysts, 2017, 7, 17
Ru-Co(III)-Cu(II)/SAC	0.1	170	180	99	1.1	Zhang H, Li W, Jin Y, et al. Appl. Catal B: Environ, 2016, 189, 56-64.

Ru/SAC-N700	1	170	180	99.8	1.1	Hou L, Zhang J, Pu Y, et al. RSC Adv, 2016, 6, 18026-18032.
Ru/AC-NHN	1	180	360	92	1.15	Xu N, Zhu M, Zhang J, et al. RSC Adv, 2015, 5, 86172-86178.
Ru1K1/SAC	1	170	180	89	1.1	Jin Y, Li G, Zhang J, et al. RSC Adv, 2015, 5, 37774-37779.

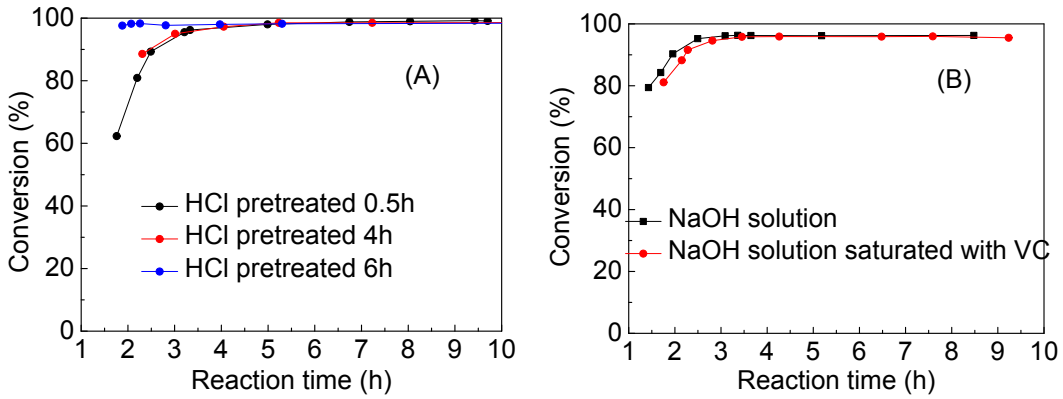

Figure S1 (A) The conversion of acetylene in acetylene hydrochlorination over $RuCl_3$-A/AC catalysts for different HCl activation time; (B) Effects of NaOH solution and saturated with VC monomer on catalyst properties. Reaction conditions: T = 180°C, GHSV(C_2H_2) = 100 h^{-1} and V_{HCl}/V_{C2H2} = 1.10.

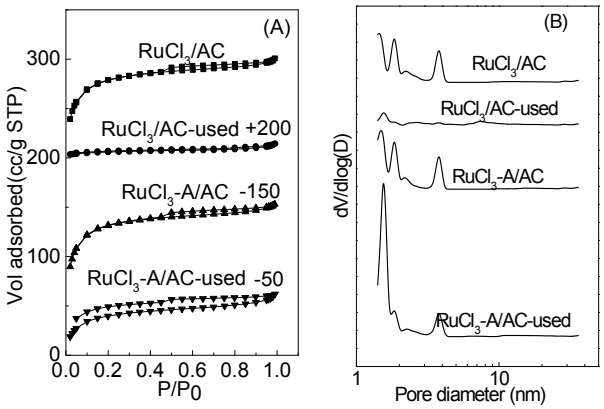

Figure S2 (A) Nitrogen adsorption-desorption isotherms and (B) pore size distributions for $RuCl_3$/AC, $RuCl_3$/AC-used, $RuCl_3$-A/AC and $RuCl_3$-A/AC-used catalysts.

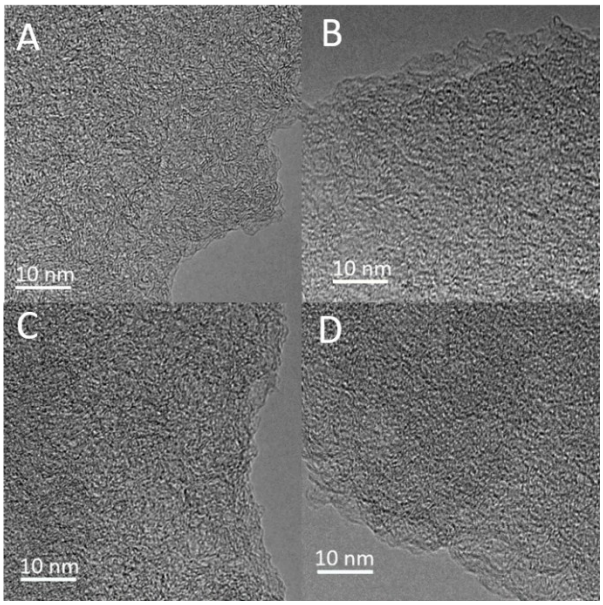

Figure S3 HRTEM images for (A): $RuCl_3$/AC; (B) $RuCl_3$/AC-used, (C) $RuCl_3$-A/AC and (D) $RuCl_3$-A/AC-used catalysts.

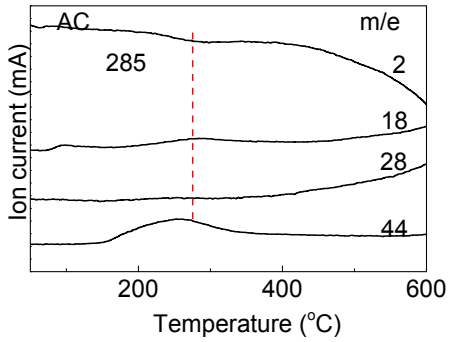

Figure S4 H_2-TPR profiles of AC

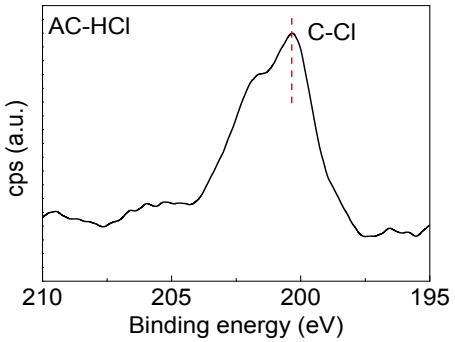

Figure S5 Cl 2p XPS spectra of AC-HCl

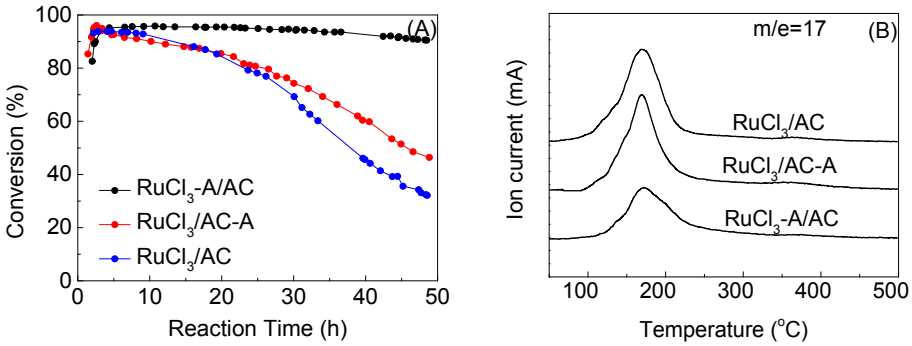

Figure S6 (A) The conversion of acetylene in acetylene hydrochlorination over Ru-based catalysts; (B) NH_3-TPD profiles of $RuCl_3$/AC, $RuCl_3$/AC-A and $RuCl_3$-A/AC

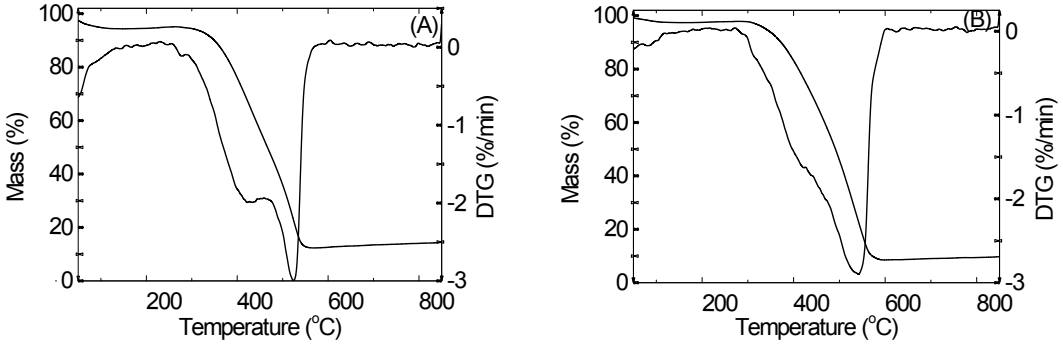

Figure S7 TG and DTG curves of (A): Ru/AC; (B): Ru/AC-used catalysts under air flow.