Supplementary Information for

# Ru/N-AC catalyst to produce vinyl chloride from acetylene and 1, 2-dichloroethane

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**Table S1**

Weight loss of fresh and used catalysts under different temperature ranges.

| Catalysts | Temperature range (°C) | | | |
|---|---|---|---|---|
| | ＜150 | 150-300 | 300-400 | 150-400 |
| Fresh 1% Ru/AC | 0.6 | 0.6 | 2.9 | 3.5 |
| Used 1% Ru/AC | 1.2 | 2.6 | 11.2 | 13.8 |
| Fresh 1% Ru/N-AC | 3.0 | 1.2 | 3.1 | 4.3 |
| Used 1% Ru/N-AC | 3.4 | 2.4 | 9.1 | 11.5 |

**Table S2**

The absolute content of Ru in the catalysts, determined by ICP-AES.

| Catalyst | Ru, wt % |
|---|---|
| Fresh 1% Ru/AC | 0.79 |
| Fresh 1% Ru/N-AC | 0.78 |
| Used 1% Ru/AC | 0.56 |
| Used 1% Ru/N-AC | 0.65 |

**Table S3**

Desorption amount of the catalysts, determined by TPD measurement.

| Samples | Desorption area of EDC | Desorption area of $C_2H_2$ | Desorption area of VCM |
|---|---|---|---|
| Fresh AC | 2497 | 2069 | 2606 |
| Fresh 1%Ru/AC | 2854 | 3828 | 2639 |
| Fresh N-AC | 5704 | 3722 | 4538 |
| Fresh 1%Ru/N-AC | 5813 | 4951 | 5029 |
| Used 1%Ru/N-AC | 3665 | 2190 | 2987 |
| Used 1%Ru/AC | 969 | 1328 | 1506 |

The weight of all these samples is 100 mg.

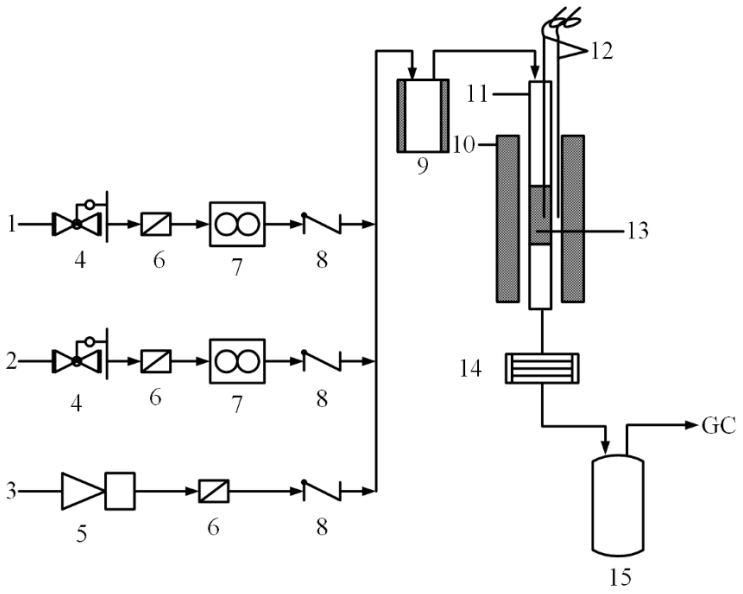


**Fig. S1.** Experimental catalyst testing setup.

1. Nitrogen, 2. Acetylene, 3. EDC, 4. Pressure relief valve, 5. Micro-injection pump, 6. Filter, 7. Mass flowmeter, 8. One-way check valve, 9. Vaporizing chamber, 10. Furnace, 11. Reactor, 12. Thermocouple, 13. Catalyst, 14. Condenser, 15. Buffer tank.

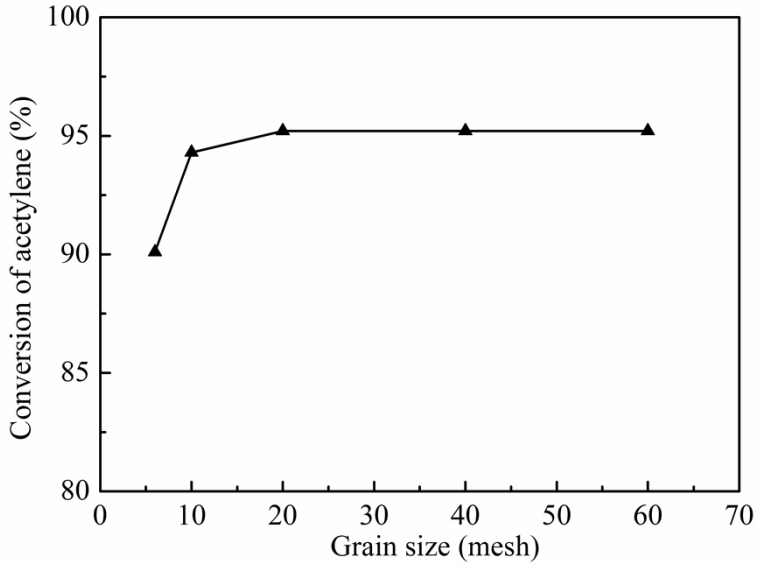


**Fig. S2.** Effect of internal diffusion factor. Reaction conditions: 250 °C, 0.1 MPa, the mass of each catalyst sample: 15 g; EDC volume flow rate: 0.10 mL $min^{-1}$, molar ratio $n(EDC)/n(C_2H_2) = 1$.

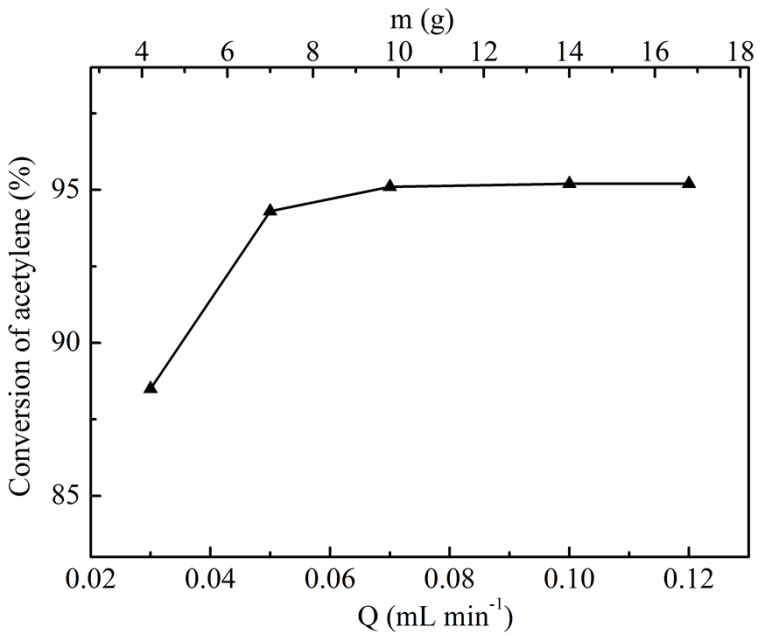


**Fig. S3.** Effect of external diffusion factor. Reaction conditions: 20-40 mesh, 250 °C, 0.1 MPa, molar ratio n(EDC)/n($C_2H_2$) = 1. (*Q*: volumetric flow rate of EDC; m: mass of catalyst).

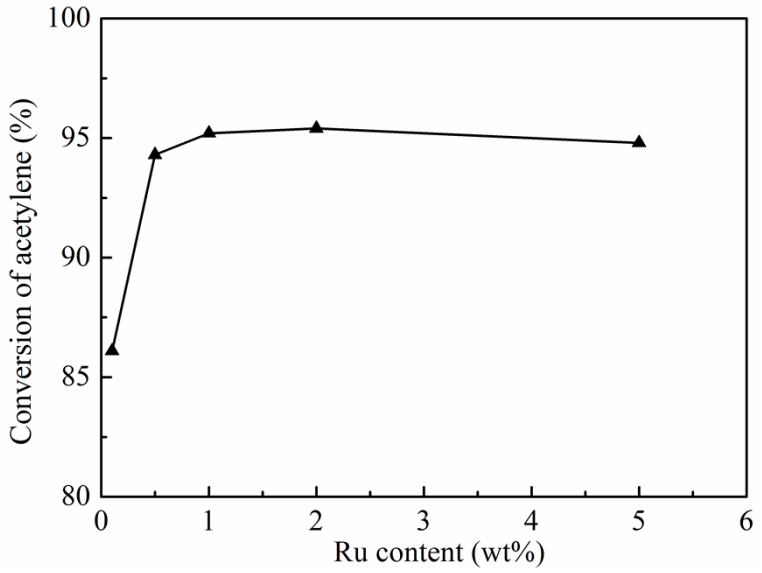


**Fig. S4.** Effect of Ru content on the activity of Ru/N-AC catalyst. Reaction conditions: 250 °C, 0.1 MPa, LHSV (EDC) = 0.2 $h^{-1}$, GHSV ($C_2H_2$) = 57 $h^{-1}$, molar ratio n(EDC)/n($C_2H_2$) = 1.

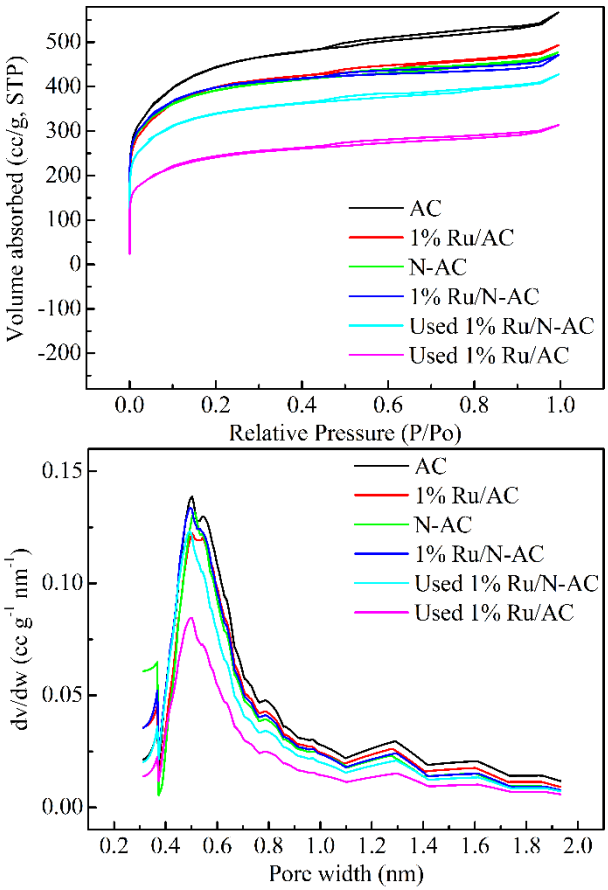


**Fig. S5.** Nitrogen adsorption-desorption isotherms and pore size distribution from HK method of the catalysts. All the isotherms belonged to type I curves, and due to abundant micropore structure in activated carbon, the H4 adsorption–desorption hysteresis loop based on IUPAC nomenclature could be observed in the isotherms.

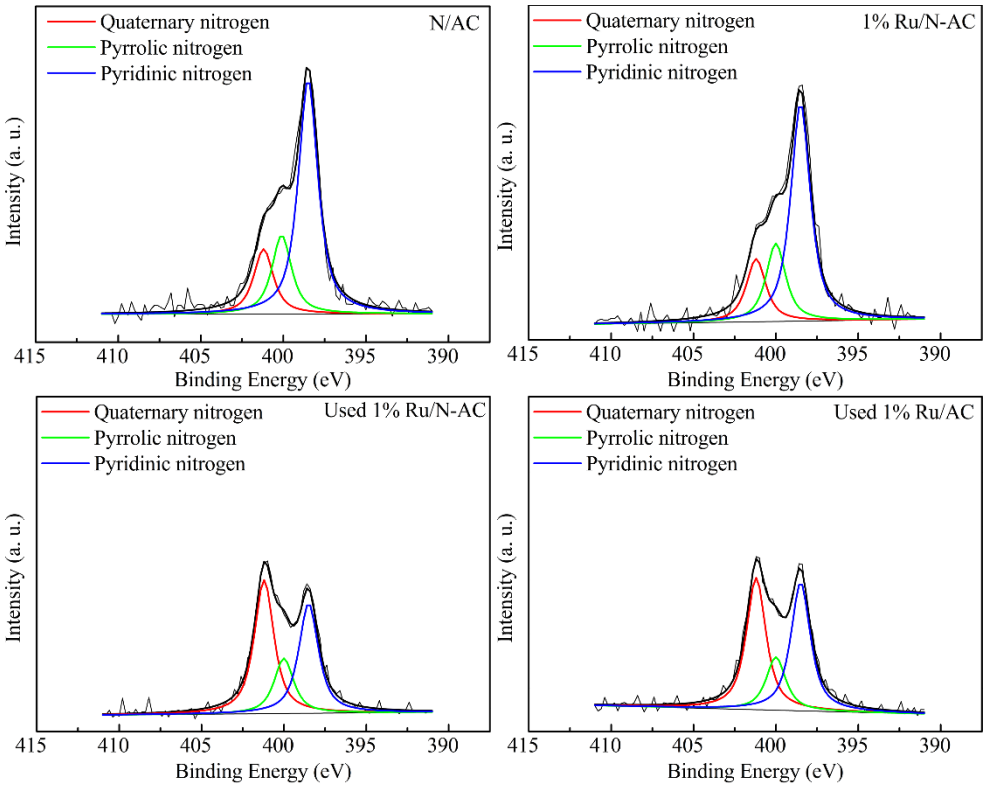


**Fig. S6.** High-resolution XPS spectra of N 1s for fresh and used catalyst.

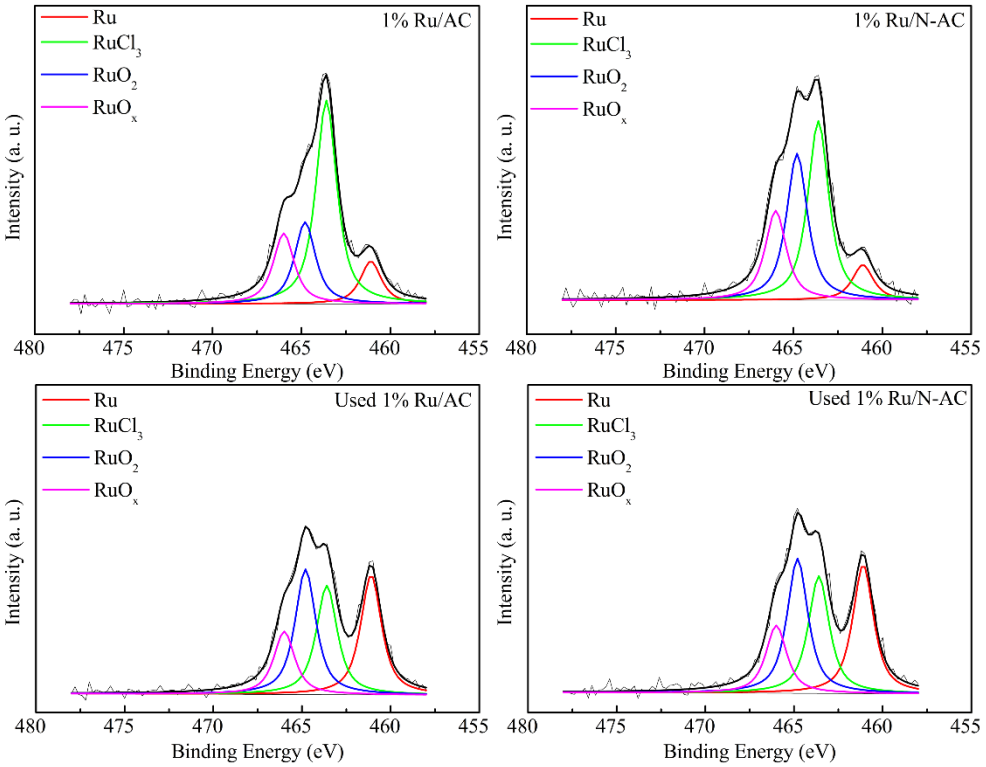


**Fig. S7.** High-resolution XPS spectra of Ru 3p for the catalysts.

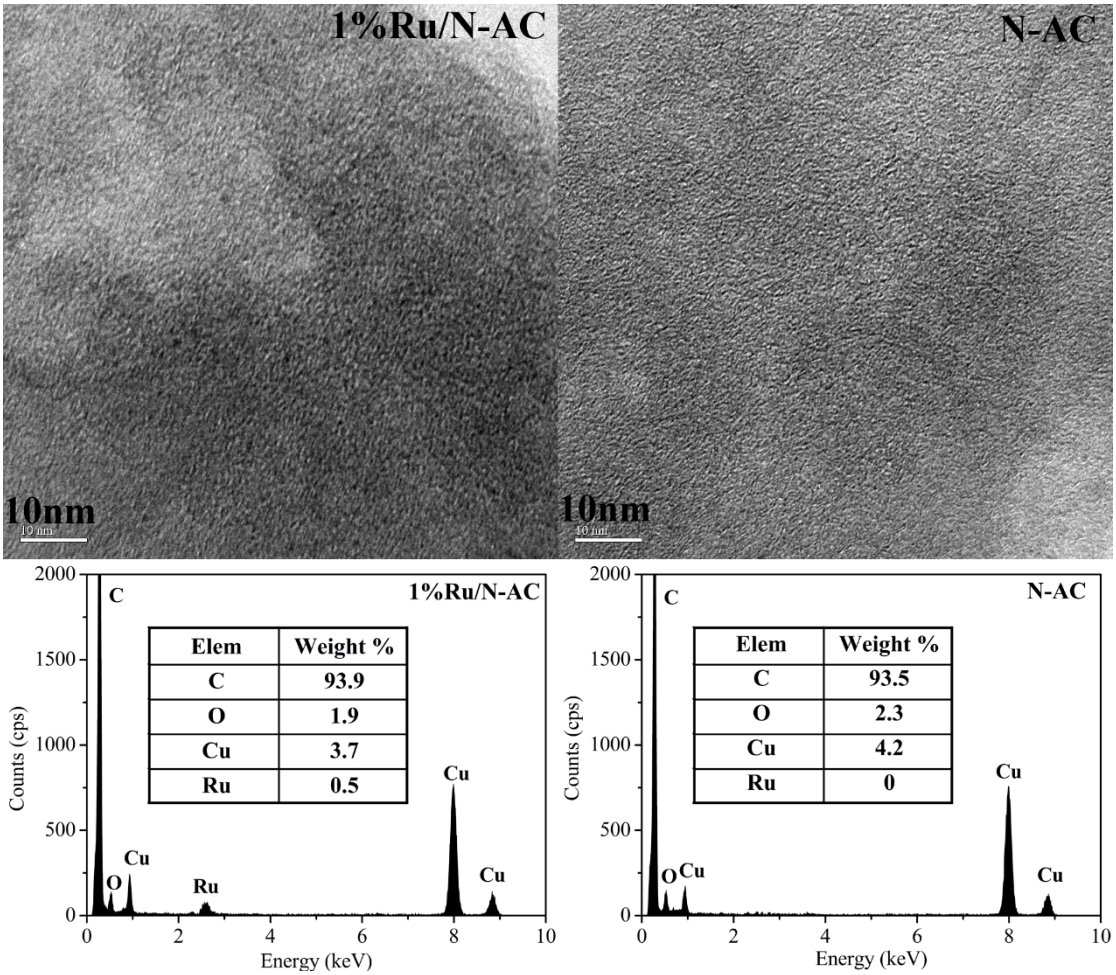


**Fig. S8.** TEM-EDX images of the catalysts.

TEM-EDX images of the 1% Ru/N-AC catalyst and the N-AC catalyst were shown in the Fig. S5. The results illustrated that there is about 0.5% weight of Ru in the 1% Ru/N-AC catalyst while none of the Ru were detected on the N-AC catalyst (0.0%).

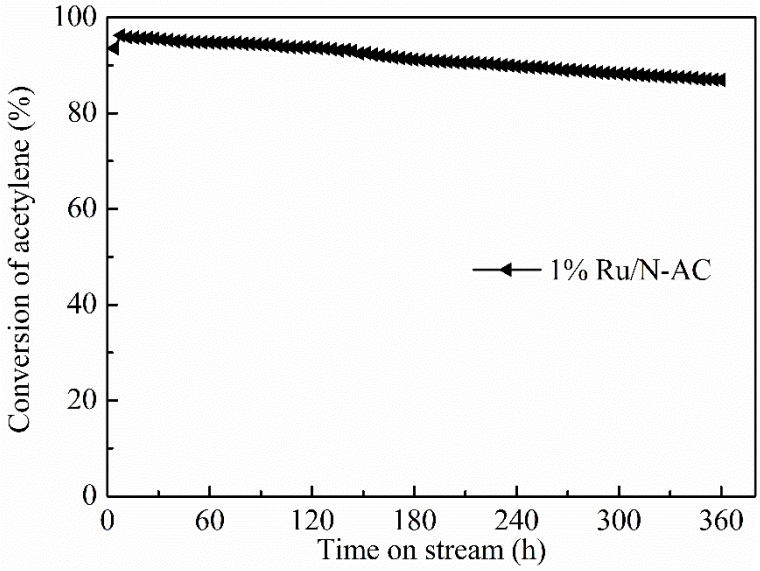


**Fig. S9.** Acetylene conversion in the one-step synthesis (A longer reaction time). Reaction conditions: 250 °C, 0.1 MPa, LHSV (EDC) = 0.2 $h^{-1}$, GHSV ($C_2H_2$) = 57 $h^{-1}$, molar ratio n(EDC)/n($C_2H_2$) = 1.