1   Supporting Information

2   Gold-glutathione complex catalyst with carbon

3   support for non-mercury catalytic acetylene

4   hydrochlorination

5

6   Xueyan Qi [a], Wei Li [a], Junjie Gu [a], Cuili Guo [a] and Jinli Zhang [*a,b]

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8   [a] School of Chemical Engineering & Technology, Tianjin University, Tianjin 300350,

9   People's Republic of China.

10   [b] School of Chemistry & Chemical Engineering, Shihezi University, Xinjiang, Shihezi

11   832000, People's Republic of China.

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13   [*] To whom correspondence may be addressed.

14   Fax: +86-22-2740-3389; Tel: +86-22-2789-0643.

15   *E-mail address*: zhangjinli@tju.edu.cn (J.L. Zhang)

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5 GSH/AC (pH 8.3) catalysts. Reaction conditions: temperature (T) = 170 °C, GHSV

6 (C_2H_2) = 360 h^{-1}, and feed volume ratio V_{HCl}/V_{C2H2} = 1.1.

7 **Fig. S2.** Selectivity to VCM over the different pH values for Au1-GSH3/AC catalysts.

8 Reaction conditions: temperature (T) = 170 °C, GHSV (C_2H_2) = 360 h^{-1}, and feed

9 volume ratio V_{HCl}/V_{C2H2} = 1.1.

10 **Fig. S3.** TG and DTG curves of the fresh and used (a) AC, (b) GSH/AC, (c) Au1-

11 GSH3/AC (pH 2), (d) Au1-GSH3/AC (pH 4.5) and (e) Au1-GSH3/AC (pH 12)

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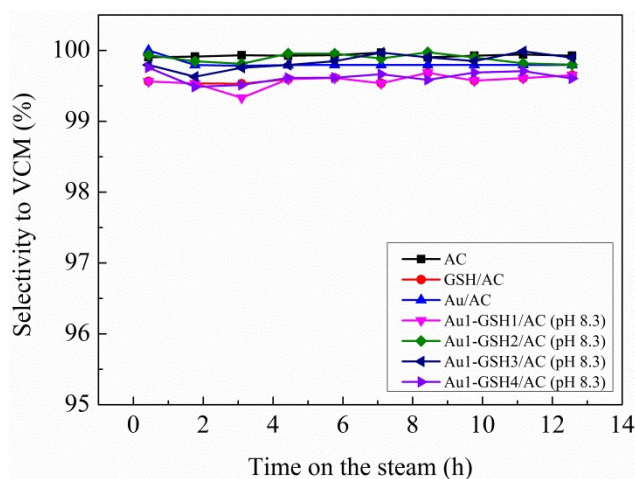
16 GSH3/AC catalysts.

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1 **Table S1** The desorption areas and desorption temperature of C_2H_2 for the fresh Au/AC and Au1-

2 GSH3/AC catalysts

| catalyst	desorption area	desorption temperature (°C)
Au/AC	762.3	236
Au1-GSH3/AC (pH 2)	1142.4	327
Au1-GSH3/AC (pH 4.5)	1210.3	329
Au1-GSH3/AC (pH 8.3)	1372.5	337
Au1-GSH3/AC (pH 12)	1573.3	322

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5 **Fig. S1** Selectivity to VCM over the different molar ratios of Au/GSH for the Au-GSH/AC (pH

6 8.3) catalysts. Reaction conditions: temperature (T) = 170 °C, GHSV (C_2H_2) = 360 h^{-1}, and feed

7 volume ratio V_{HCl}/V_{C2H2} = 1.1.
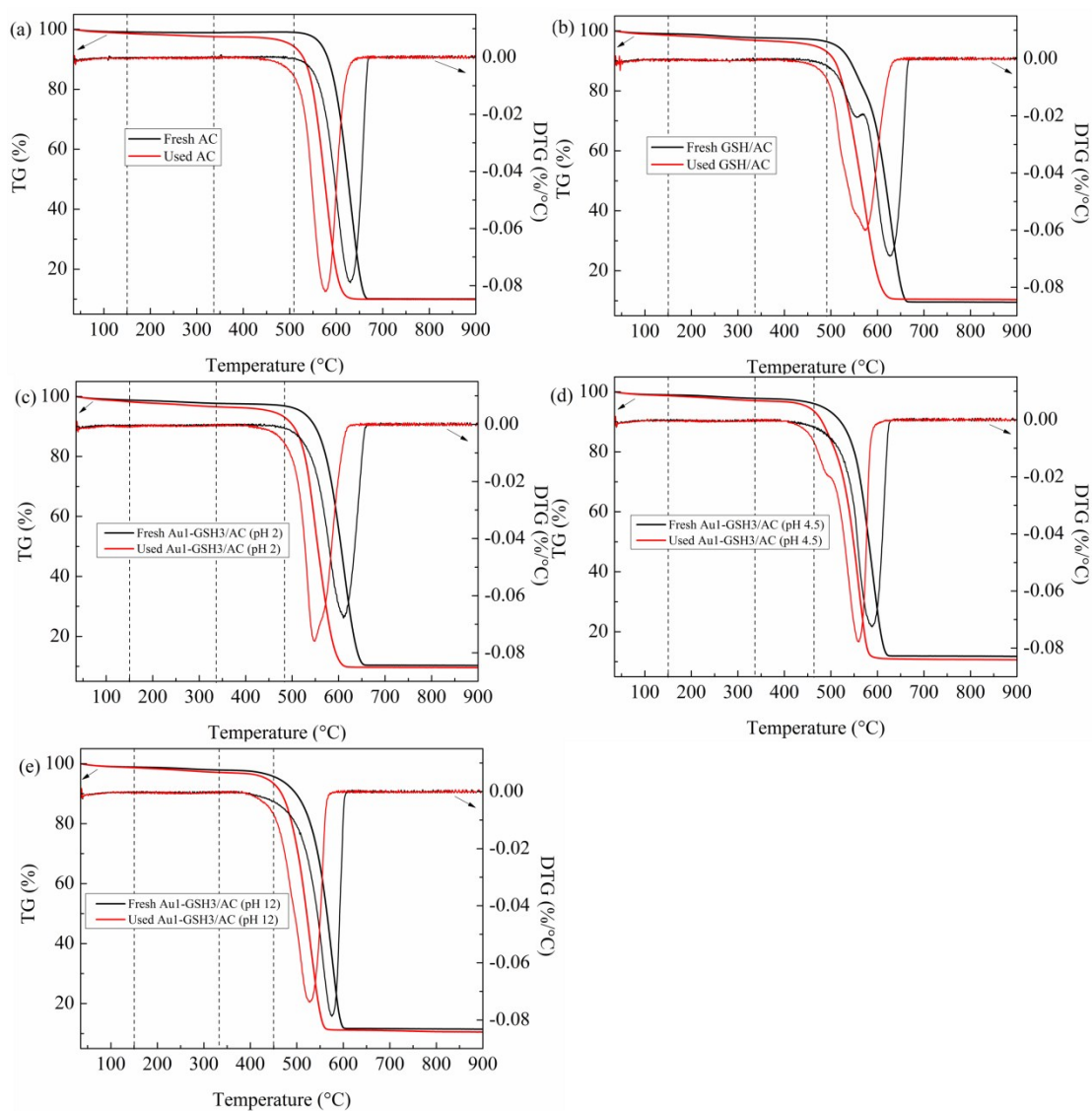
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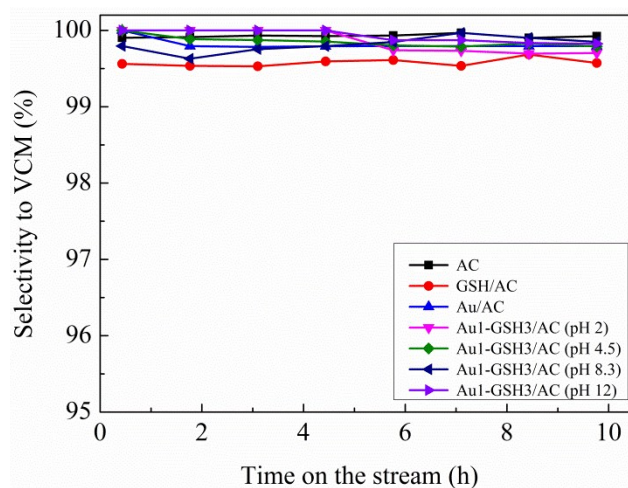
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2   **Fig. S2** Selectivity to VCM over the different pH values of Au1-GSH3/AC catalysts. Reaction

3   conditions: temperature (T) = 170 °C, GHSV (C_2H_2) = 360 h^{-1}, and feed volume ratio V_{HCl}/V_{C2H2}

4   = 1.1.

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2 **Fig. S3** TG and DTG curves of the fresh and used (a) AC, (b) GSH/AC, (c) Au1-GSH3/AC (pH

3   2), (d) Au1-GSH3/AC (pH 4.5) and (e) Au1-GSH3/AC (pH 12) catalysts.

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5 We have treated the coal-based activated carbon in two ways, the methods are

6 shown below.

7 (1) Hydrochloric acid treated

8 The activated carbon (20 g) was initially washed with 100 ml HCl (1 mol L^{-1})

9 aqueous solution at 70 °C for 5 h to remove possible impurities of Na, Fe and Cu,

1   then the carbon was filtered and washed with distilled water until the pH value equals

2   to pH 7 and dried at 150 °C for 12 h [1]. The final sample was denoted as HCl-AC.

3   (2) Hydrofluoric acid treated:

4   The activated carbon (20 g) was pretreated with the mixture solution of 75 ml HF

5   (29 mol L^{-1}) and 25 ml HCl (12 mol L^{-1}) at 60 °C for 12 h, then the carbon was

6   filtered and washed by the distilled water until the pH value equals to pH 7 followed

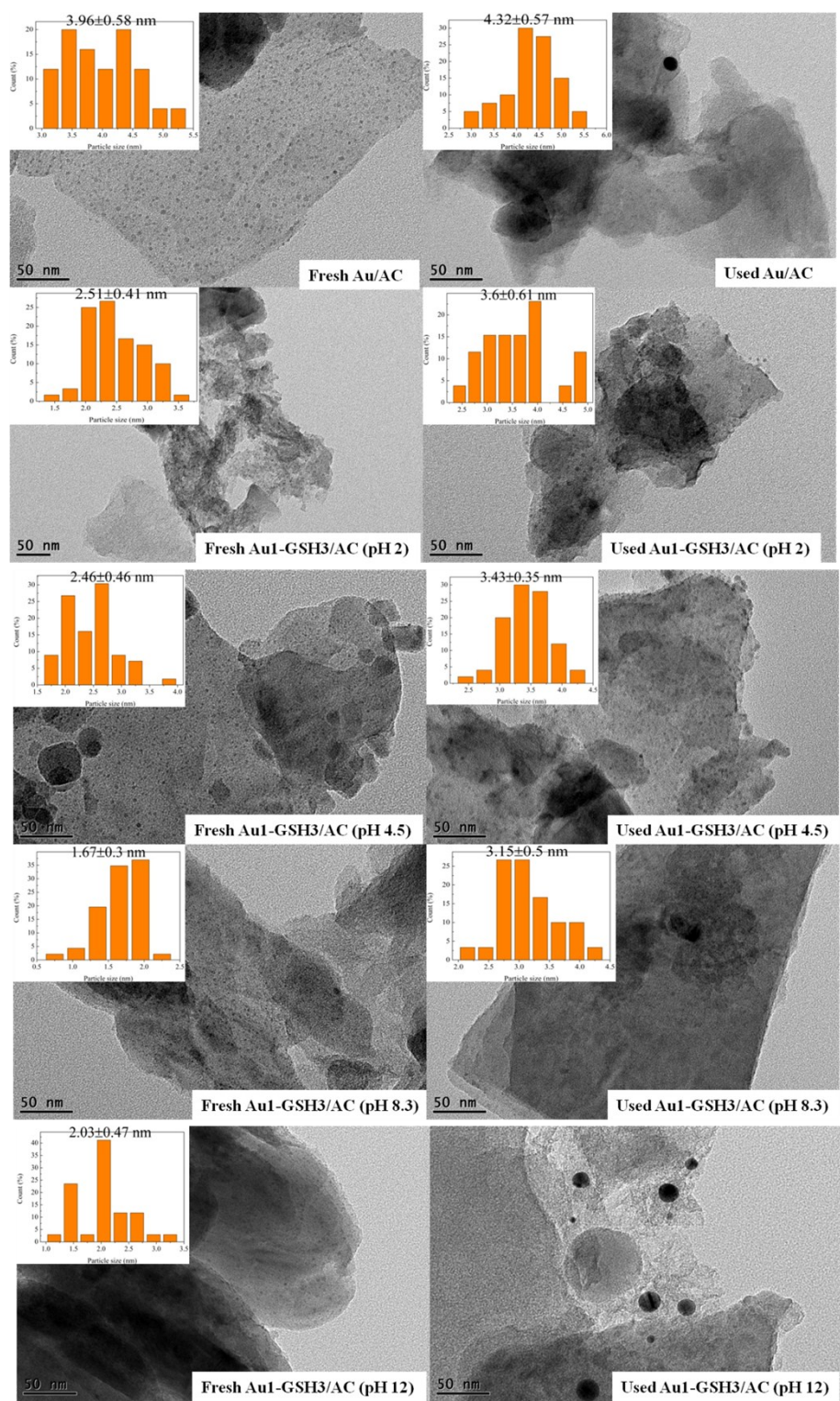7   by vacuum drying at 105 °C for 12 h [2]. The obtained sample was denoted as HF-AC.

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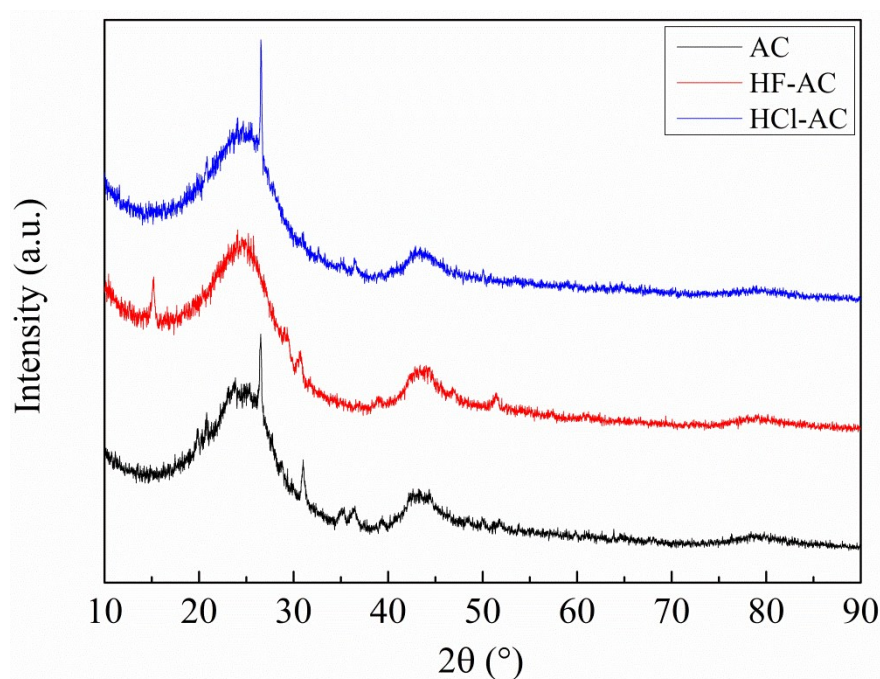
10   **Fig. S4** XRD patterns of the AC, HF-AC and HCl-AC samples.

11   [1] H. Y. Zhang, B. Dai, X. G. Wang, W. Li, Y. Han, J. J. Gu and J. L. Zhang, *Green Chem.*, 2013,
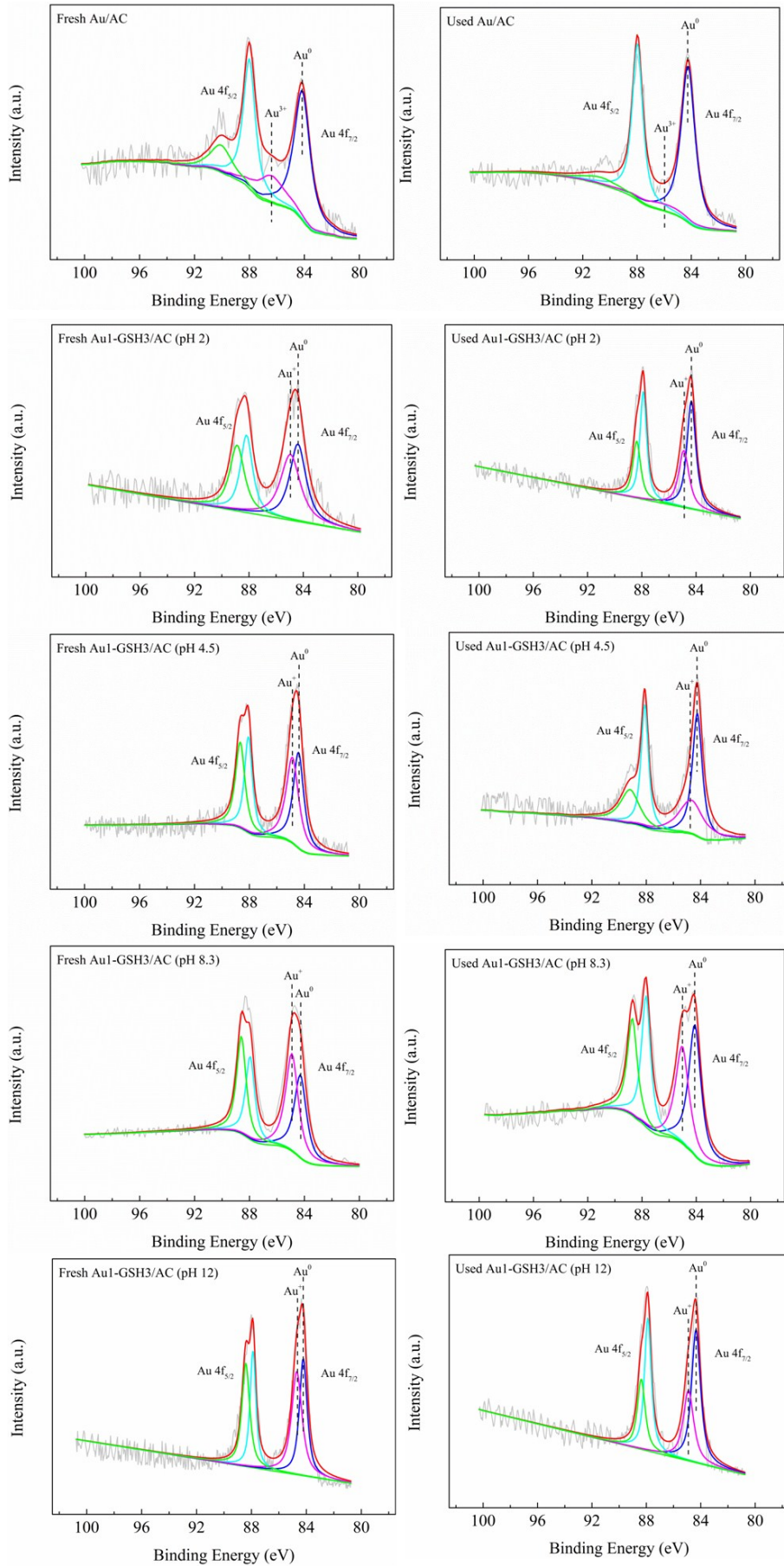
12   **15**, 829.

13   [2] C. W. Dale, C. G. Macpherson, D. G. Pearson, S. J. Hammond and R. J. Arculus, *Geochimica*

14   *et Cosmochimica Acta.*, 2012, **89**, 202.

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Fig. S5 TEM images and the particle size distribution of the fresh and used catalysts.

1   **Fig. S6** High-resolution XPS spectra of Au 4f for fresh and used Au/AC and Au1-GSH3/AC

2   catalysts.