Efficient production of ethylene glycol from cellulose over Co@C catalysts combined with tungstic acid

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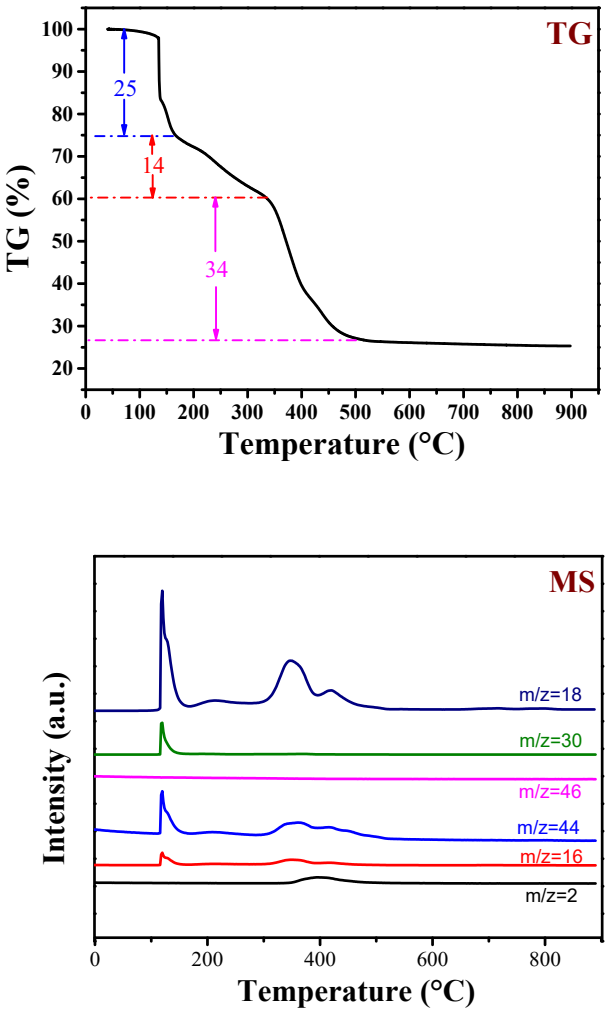

Figure S1. TG-MS analysis of Co-CA precursor

The experiment was conducted at the heating rate of 10 °C/min under 100 ml/min N_2 flow. The outlet gases from the decomposition was monitored by H_2 (m/z=2), CH_4 (m/z=16), H_2O (m/z=18), NO (m/z=30), CO_2/N_2O (m/z=44), and NO_2 (m/z=46). Three main weight losses of about 25%, 14% and 34% were observed in the range of 150 °C-170 °C, 170 °C-350 °C and 350 °C-500 °C during the decomposition, respectively. Based on the MS measurements, the weight losses were ascribed to the release of NO and/or N_2O decomposed from NO_3- residue and CH_4, H_2O, and CO_2 from citric acid moiety in Co-CA, respectively. And those gases could promote the reduction of Co^{2+} to zero-valent Co as auxiliary reducing agents during the carbonization process of Co-CA.

Table S1 Comparison of catalytic performance over various catalysts for the production of EG from cellulose

Entry	Catalyst	Conditions	EG yield (C-mol %)	Reference
1	Ru/MC+TA	245°C, 6 MPa	50.9	1
2	Ni-W_2C/AC	240°C, 6 MPa	53.2	2
3	AMT-Ru/AC	240°C, 5 MPa	46.7	3
4	Ru/C+PTA/ZrO_2	220°C, 5 MPa	40.0	4
5	Raney Ni+TA	245°C, 6 MPa	56.6	5
6	Ni-W/MIL-125 (Ti)	245°C, 4 MPa	68.7	6
7	Al-WO_3-Ni-TUD-1	230°C, 4 MPa	66.2	7
8	Cu-WO_x/AC+Ni/AC	245°C, 4 MPa	58.0	8
9	**Co@C+TA**	**240°C, 3 MPa**	**67.3**	**This work**

Table S2 Influence of reaction temperature of Co@C catalyst combined with TA on the yield of main gas products in cellulose conversion

Entry	Temperature (°C)	Gas phase yield (C-mol%)	Products selectivity (%)	
			CH_4	C_2-C_5 hydrocarbon
1	230	1.16	64.7	8.1
2	240	1.53	82.3	17.7
3	250	1.29	79.1	20.9

Reaction conditions: 0.2 g cellulose, Co@CA-700-3h (30 mg), TA (80mg), 20ml DW, 3.0 MPa H_2, 3 h.

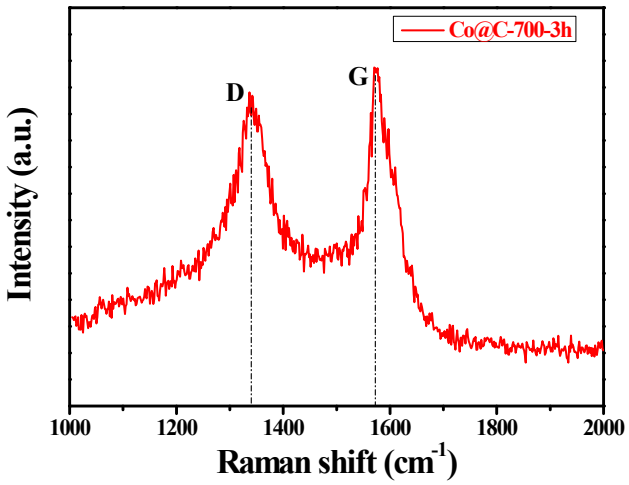

Figure S2. Raman spectrum of Co@C-700-3h catalyst

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