

## Electronic Supplementary Material

# Synthesis of tetrahedrally coordinated CoO for higher alcohol synthesis directly from syngas

Zhuoshi Li<sup>1,2\*</sup>, Han Yang<sup>1\*</sup>, Xiaofeng Pei<sup>1</sup>, Jiahui Li<sup>1</sup>, Jing Lv<sup>1,3</sup>, Shouying Huang<sup>1,3</sup>, Yue Wang (✉)<sup>1,2,3</sup>, Xinbin Ma<sup>1,3</sup>

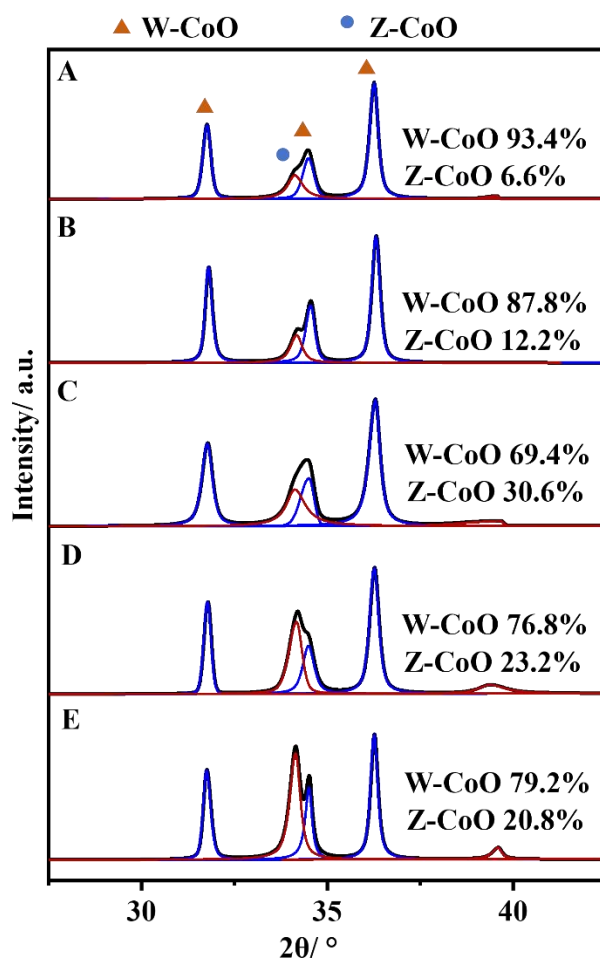
1 Key Laboratory for Green Chemical Technology of Ministry of Education, Collaborative Innovation Center of Chemical Science and Engineering, School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, China

2 Joint School of National University of Singapore and Tianjin University, International Campus of Tianjin University, Binhai New City, Fuzhou 350207, China

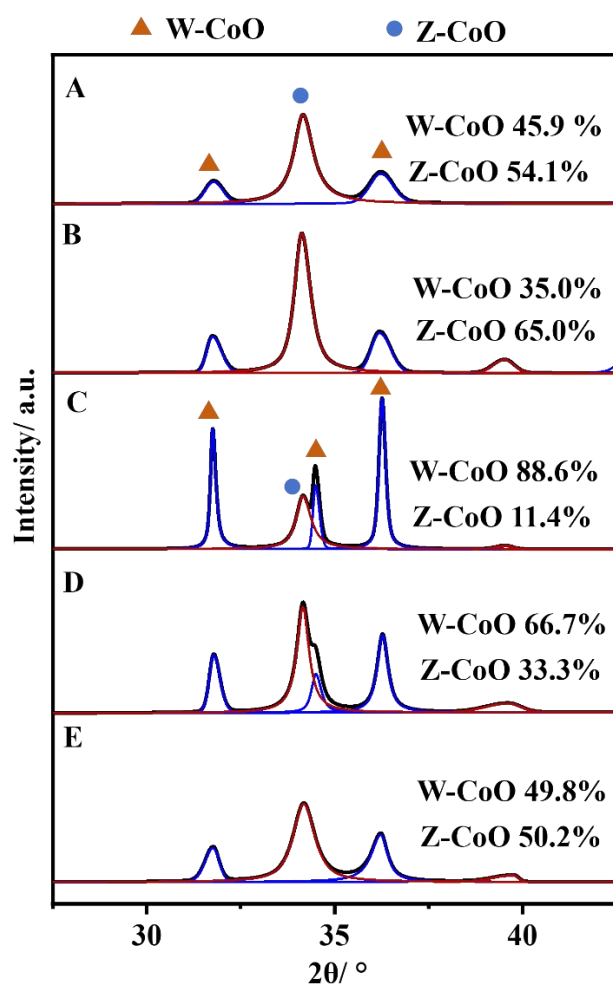
3 Haihe Laboratory of Sustainable Chemical Transformations, Tianjin 300192, China

E-mail: [yuewang@tju.edu.cn](mailto:yuewang@tju.edu.cn)

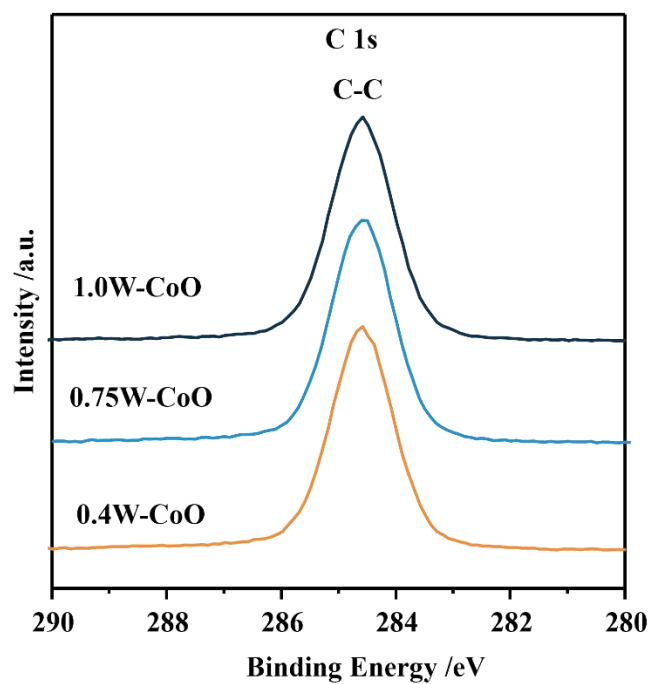
\*These authors contributed equally to this work.



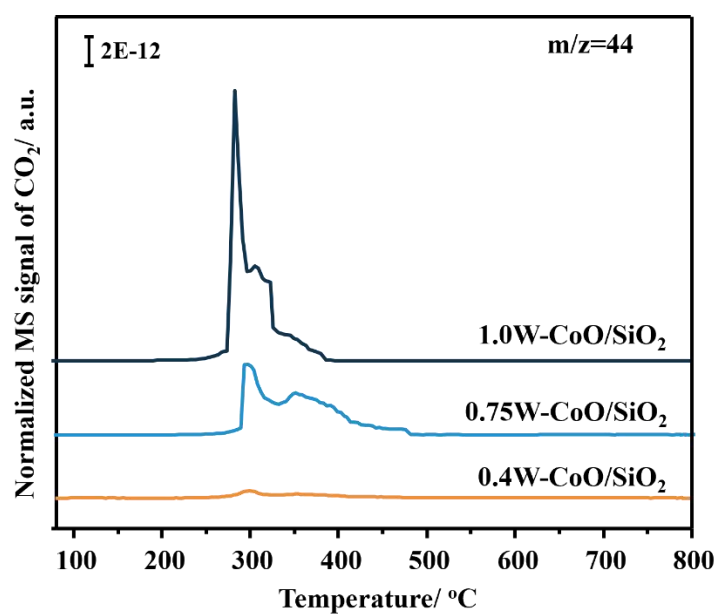
**Fig. S1** The XRD patterns and peak-fitting results of the CoO samples synthesized by the thermal decomposition method using 1-octadecene as the solvent and oleic acid as the surfactant. Other synthesis conditions were listed in Table S1.



**Fig. S2** The XRD patterns and peak-fitting results of the CoO samples synthesized by the thermal decomposition method using dibenzyl ether as the solvent and oleic acid as the surfactant. Other synthesis conditions were listed in Table S2.



**Fig. S3** C 1s XPS spectra of the spent xW-CoO/SiO<sub>2</sub> catalysts.



**Fig. S4** The MS signal with CO<sub>2</sub> during the CO-TPD of the xW-CoO/SiO<sub>2</sub> catalysts.

**Table S1.** Synthesis conditions of the thermal decomposition method using 1-octadecene as the solvent.

Sample	Cobalt (III) acetylacetonate concentration/ mol·L <sup>-1</sup>	Reaction Temperature/ °C	Reflux Time/ min
A	0.20	300	60
B	0.97	300	60
C	0.97	270	30
D	0.20	300	30
E	0.97	300	30

**Table S2.** Synthesis conditions of the thermal decomposition method using dibenzyl ether as the solvent.

Sample	Cobalt (III) acetylacetonate concentration/ mol·L <sup>-1</sup>	Reaction Temperature/ °C	Reflux Time/ min
A	0.20	300	30
B	0.20	300	15
C	0.97	300	30
D	0.97	300	15
E	0.20	250	30