Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Supplementary Information for

Synthesis of Ceria Supported Iron-Ruthenium Oxide Catalyst and Its Structural Transformation from Subnanometer Clusters to Single Atoms during Fischer-Tropsch Synthesis Reaction

Xu Wang[a,b], Xin-Pu Fu[c], Wen-Zhu Yu[c], Chao Ma[d,], Chun-Jiang Jia[c,]*, Rui Si[a,]**

[a] Shanghai Synchrotron Radiation Facility, Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai 201204, China

[b] University of Chinese Academy of Science, Beijing 10049, China

[c] Key Laboratory for Colloid and Interface Chemistry, Key Laboratory of Special Aggregated Materials, School of Chemistry and Chemical Engineering, Shandong University, Jinan 250100, China

[d] Center for High Resolution Electron Microscopy, College of Materials Science and Engineering, Hunan University, Changsha 410082, China.

Table S1. Comparison of FTS activities over the representative iron catalysts.

Catalyst	*T* (°C)	Conditions	CO conv. (%)	Activity ($10^{-5}mol_{CO}\cdot g_{Fe}^{-1}\cdot s^{-1}$)	Selectivity CO_2	CH_4	C_2-C_4	C_{5+}	Ref.
10wt.%Fe_2O_3/Al_2O_3	260	H_2/CO=2; 2000 $mL\cdot h^{-1}\cdot g_{Cat}^{-1}$; 2 MPa	10.5	0.9	11.6	15.1	35.5	49.4	21
	300		22.2	2.0	21.0	28.9	41.8	29.3	
5wt.%Fe/CNTs	300	H_2/CO=1; 4200 $mL\cdot h^{-1}\cdot g_{Cat}^{-1}$; 1 MPa	14.4	2.7	18.6	22.2	52.4	25.4	25
9wt.%Fe_5C_2/SiO_2	270	H_2/CO=2; 15000 $mL\cdot h^{-1}\cdot g_{Cat}^{-1}$; 3 MPa	39.0	23.6	39	42	19	39	38
ε-Fe_2C	150	H_2/CO=2; 3 MPa	85	7.9	10	9	15	76	24
	170		76	21.3	18	16	30	54	
	200		36	35.2	24	27	45	28	
4.7wt.%Fe_2O_3/CeO_2 (**Fe_Ce**)	250	H_2/CO=1; 12000 $mL\cdot h^{-1}\cdot g_{Cat}^{-1}$; 2 MPa	0.8	1.5	25	16	41	43	our work
	300		8.7	16.9	26	13	37	50	
4.8wt.%Fe_2O_3/0.3wt.%Ru/CeO_2 (**FeRu_Ce**)	250		7.1	13.4	47	34	52	14	
	300		15.7	28.4	45	27	45	28	

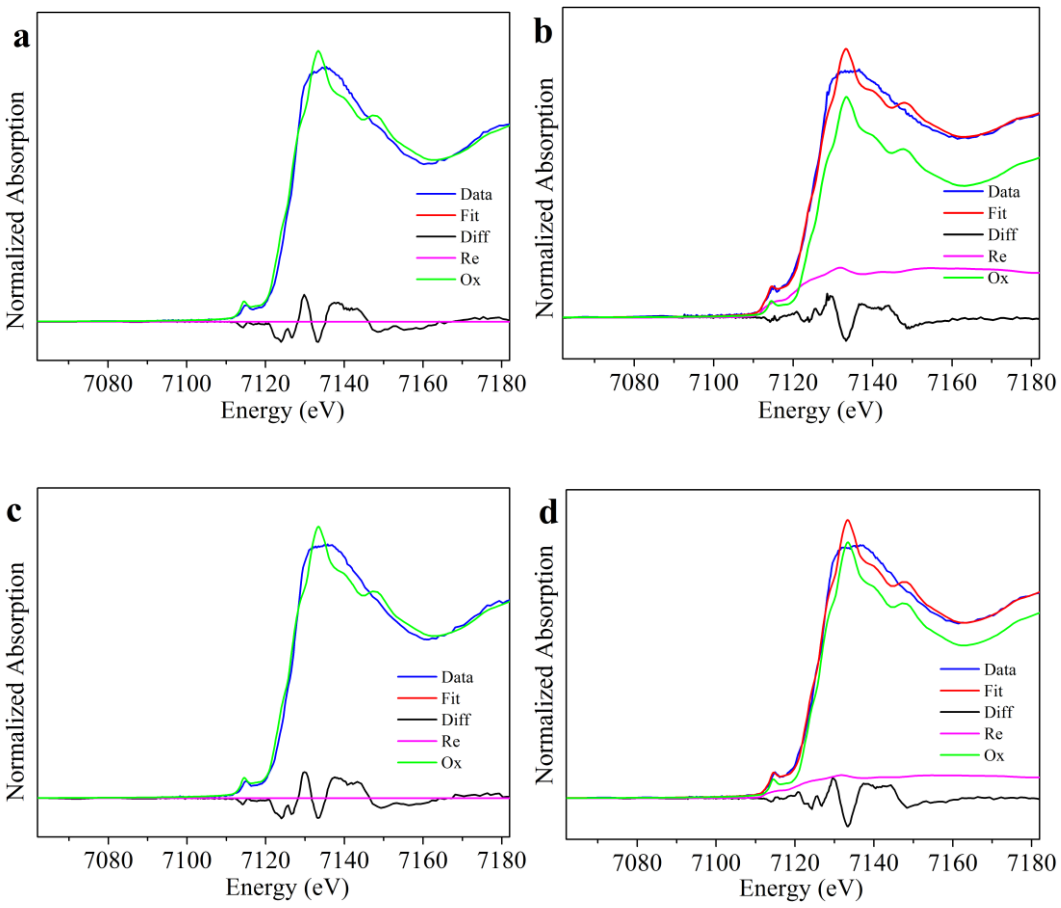

Figure S1. XANES profiles for linear combination fits results on Fe K edge of fresh (a,c) and used (b,d) ceria-supported iron-ruthenium oxide samples: (a,b) **Fe_Ce**; (c,d) **FeRu_Ce**.

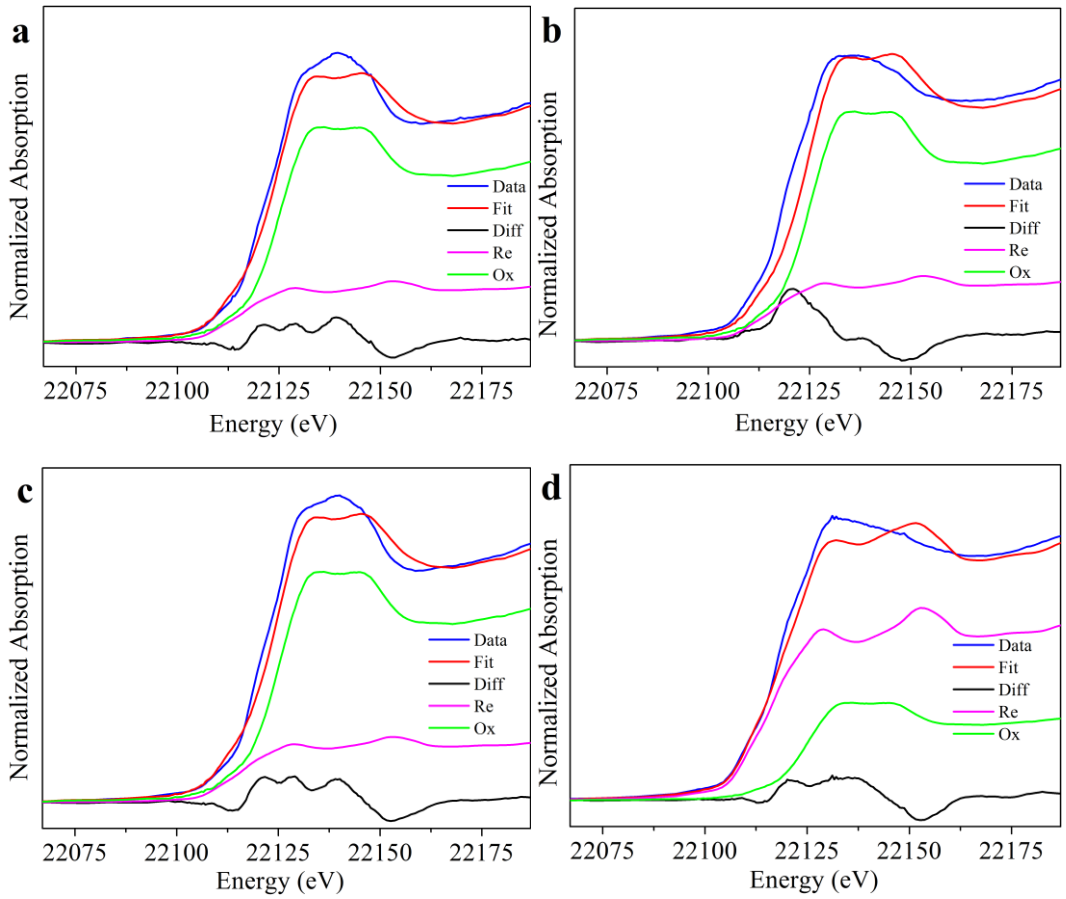

Figure S2. XANES profiles for linear combination fits results on Ru K edge of fresh (a,c) and used (b,d) ceria-supported iron-ruthenium oxide samples: (a,b) **Ru_Ce**; (c,d) **FeRu_Ce**.

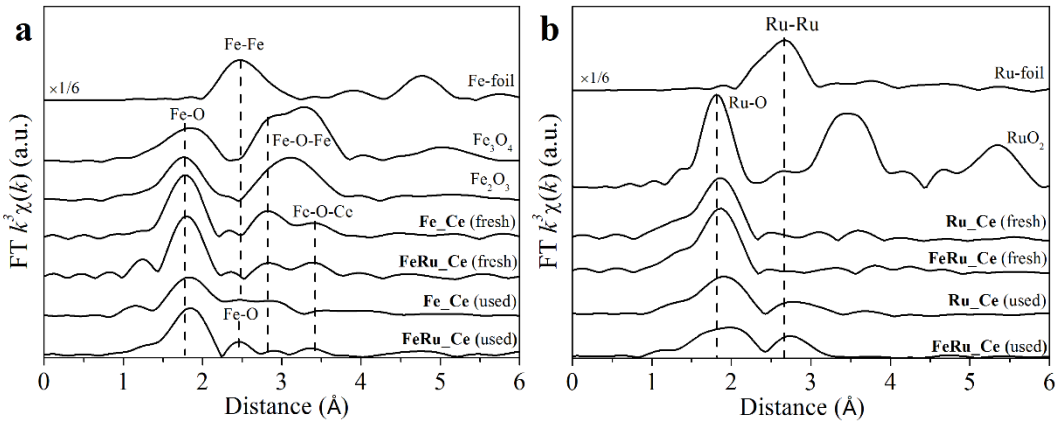

Figure S3. EXAFS results in *R* space for ceria-supported iron-ruthenium oxide samples and standard model: (a) Fe K edge; (b) Ru K edge

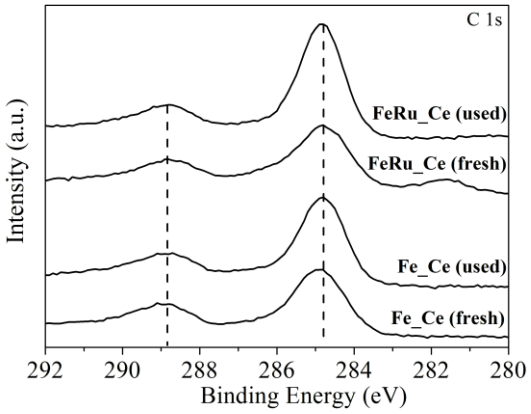

Figure S4. XPS spectra of C 1s for ceria-supported iron-ruthenium oxide samples.