

Supplementary information

Selective catalytic and kinetic studies on oxydehydrogenation of ethane with CO₂ over lanthanide metal catalysts

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Table S1 Chemicals and raw materials used in catalyst preparation

Raw materials	Specifications	Manufacturer
SiO ₂	Gas-phase SiO ₂	Shanghai Aladdin Bio- Chem Technology Co., LTD
LaN ₃ O ₉ ·6H ₂ O	AR, 99.0%	Shanghai Aladdin Bio- Chem Technology Co., LTD
SmN ₃ O ₉ ·6H ₂ O	99.9% metals basis	Shanghai Aladdin Bio- Chem Technology Co., LTD
CeN ₃ O ₉ ·6H ₂ O	99.5% metals basis	Shanghai Aladdin Bio- Chem Technology Co., LTD

Table S2 Gas used in catalyst activity experiment

Gas	Specifications	Manufacturer
N ₂	99.9%	Chongqing Ruike Gas Co., LTD.
N ₂	99.999%	Chongqing Ruike Gas Co., LTD.
C ₂ H ₆	99.9%	Beijing Huatong Jingke Gas Chemical Co., LTD.
CO ₂	99.9%	Chongqing Ruike Gas Co., LTD.
H ₂	99.999%	Beijing Huatong Jingke Gas Chemical Co., LTD.
He	99.999%	Chongqing Ruike Gas Co., LTD.
O ₂	99.9%	Beijing Huatong Jingke Gas Chemical Co., LTD.

Table S3 Instrumentation used in the experiment

Instrumentation	Specifications	Manufacturer
Three-channel fixed bed reactor	The temperature of the three reactors is independent and the temperature range is 25-1100 °C.	AOZHAN
Preheater and reactor	Horizontal heater with a temperature range of 25-800 °C	AOZHAN
Thermocouple	K type, accuracy: ± 0.1 °C	Shenyang Zhongse Co., Ltd.
Mass flowmeter	H ₂ : 0-50 mL/min	Beijing Sevenstar Electronics Co., Ltd.
	C ₂ H ₆ : 0-50 mL/min	
	CO ₂ : 0-50 mL/min	
	N ₂ : 0-150 mL/min	
Flow control instrument	N ₂ : 0-2500 mL/min	Xiamen Yudian Automation Technology Co., Ltd.
	Type: D07-19B	
	Type: 519E+S	
Program temperature control instrument	Type: 518PE+S	Xiamen Yudian Automation Technology Co., Ltd.
Temperature display instrument	Type: 706M+S	Xiamen Yudian Automation Technology Co., Ltd.
Dryer	Models 30-60	Memmert
Muffle furnace	—	Shanghai Haozhi Mechanical and Electrical Equipment Co., LTD.
Analytical Balances	Forerunner	OHAUS
Gas Chromatograph	ISQ QD-TRACE1300	Thermo Fisher
Chromatography workstation	Thermo Fisher Workstation	Thermo Fisher