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Supporting Information

Revealing the Catalytic Role of Sn Dopant in CO₂-Oxidative Dehydrogenation of Propane over Pt/Sn-CeO₂ Catalyst

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Characterizations of catalysts

Powder X-ray diffraction patterns (XRD) was conducted on a PANalytical X-Pert PRO diffractometer, using Cu-K α radiation at 40 kV and 20 mA. Continuous scans were collected in the 2θ ranging from 10° to 75° , at a step rate of $10^\circ \text{ min}^{-1}$. Raman spectra were collected with a 532 nm constant-wave laser (Senterra, Bruker, Germany) served as the excitation source. C₃H₈-TPD was performed on a Micromeritics Autochem 2920 instrument. About 0.2 g of the sample was pre-reduced at 450 °C for 1 h in 5 vol% H₂/Ar. After this, the sample was cooled to 70 °C and purged with Ar. Then, the pre-treated sample was saturated with pure C₃H₈ with a flow rate of 30 mL/min for 1 h. Then, the sample was purged by an Ar stream for 1 h, and temperature-programmed desorption of C₃H₈ was performed from 70 to 600 °C at a heating rate of 10 °C/min. The amount of desorbed C₃H₈ was monitored and determined by a pre-calibrated thermal conductivity detector (TCD).

Figures and tables

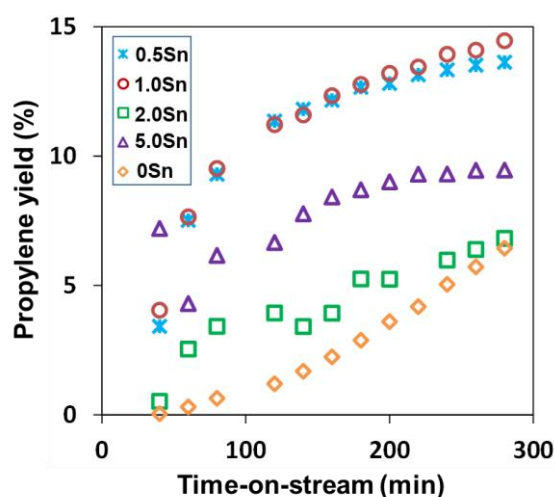


Fig. S1. Propylene yield over 1.0 Pt/CeO₂ and 1.0 Pt/*n* Sn-CeO₂ with various Sn doping amounts ranging from 0.5 wt% to 5 wt% in CO₂-ODHP reaction.

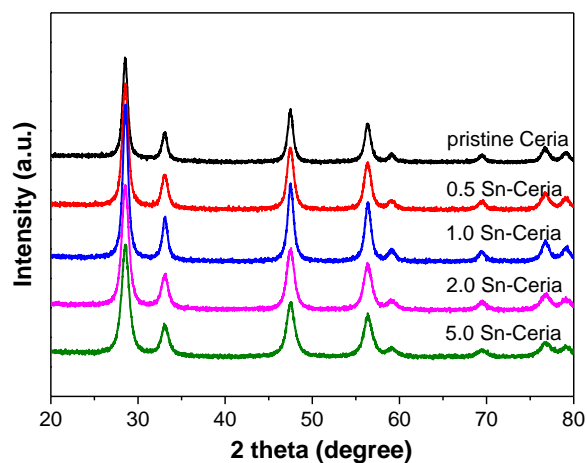


Fig. S2. XRD patterns of pristine CeO_2 and various Sn doped CeO_2 .

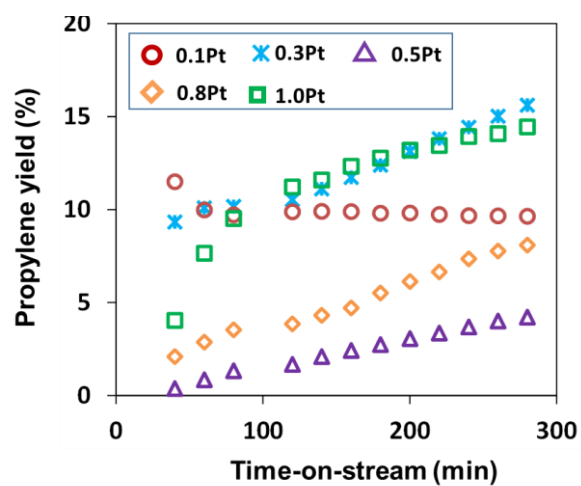


Fig. S3. Propylene yield over m Pt/1.0 Sn- CeO_2 with various Pt loading amounts ranging from 0.1 wt% to 1.0 wt% in CO_2 -ODHP reaction.

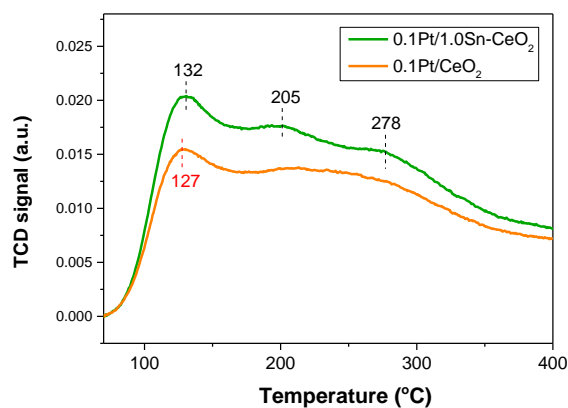


Fig. S4. The C_3H_8 -TPD results of 0.1Pt/ CeO_2 and 0.1 Pt/1.0 Sn- CeO_2 .

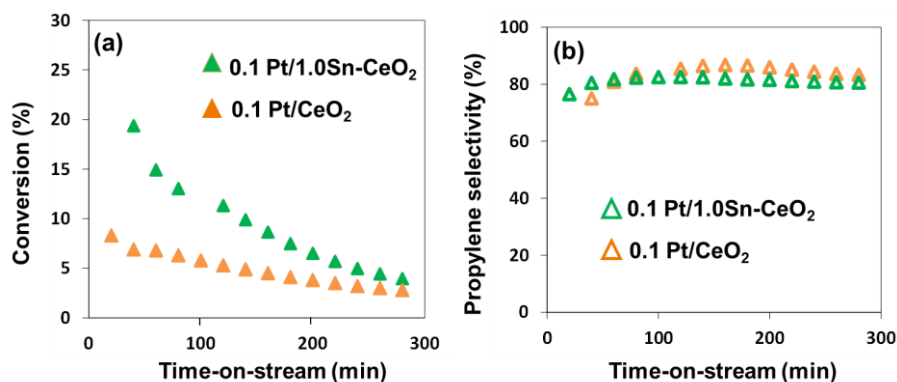


Fig. S5. Catalytic direct dehydrogenation of propane over 0.1 Pt/CeO₂ and 0.1 Pt/1.0 Sn-CeO₂, respectively. (a) Conversion of propane; (b) propylene selectivity. Reaction conditions: catalysts, 1.0 g, 40-60 mesh; the feeding speed of propane is 2.4 mL/min; the reactions were conducted at 550 °C with N₂ as carrier gas (10 mL/min); before the reaction, the catalysts were pretreated in H₂ (10 mL/min) at 450 °C for 1 h.

Table S1. Catalytic performances of various catalysts.

Entry	Catalyst	Conversion (%)	Selectivity (%)
1	-	<2	--
2	0.1 Pt/1.0 Sn-CeO ₂	15.1	63.9
3	0.1 Pt/CeO ₂	14.3	22.3
4	1.0 Sn-CeO ₂	7.1 ^[a]	31.0 ^[a]

Reaction conditions: catalysts, 1.0 g, 40-60 mesh; the feeding speed of propane and CO₂ is 2.4 mL/min and 4.8 mL/min, respectively; these reactions were conducted at 550 °C for 240 min with N₂ as carrier gas (10 mL/min); before the reaction, these catalysts were pretreated in H₂ (10 mL/min) at 450 °C for 1 h; [a] 100 min.