

Supplementary Information

Optimizing Methane Oxidative Coupling over La_2O_3 : Kinetic and Product Analysis

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Table S1. Experimental setup for catalysts at different operating parameters.

operating parameters	Sample mass (mg)	GHSV (mL·g ⁻¹ ·h ⁻¹)	Total flowrate (sccm)	Feed gas (%)
methane to oxygen ratio	25	44640	20	CH ₄ : O ₂ : Ar=70:23:7
	25	44640	20	CH ₄ : O ₂ : Ar=77.5:15.5:7
	25	44640	20	CH ₄ : O ₂ : Ar=85:8:7
GHSV	25	14880	6.7	CH ₄ : O ₂ : Ar=70:23:7
	25	29760	13.3	CH ₄ : O ₂ : Ar=70:23:7
	25	44640	20	CH ₄ : O ₂ : Ar=70:23:7
	12	65100	14	CH ₄ : O ₂ : Ar=70:23:7
	12	93000	20	CH ₄ : O ₂ : Ar=70:23:7
	6	186000	20	CH ₄ : O ₂ : Ar=70:23:7
H ₂ O in feed gas	25	14880	6.7	CH ₄ : O ₂ : Ar: H ₂ O=70:23:6:1
	25	14880	6.7	CH ₄ : O ₂ : Ar: H ₂ O=70:23:6:1
	25	44640	20	CH ₄ : O ₂ : Ar: H ₂ O=70:23:6:1
	25	44640	20	CH ₄ : O ₂ : Ar: H ₂ O=70:23:6:1
CO in feed gas	25	44640	20	CH ₄ : O ₂ : Ar=70:23:7
	25	44640	20	CH ₄ : O ₂ : Ar: CO=70:23:6:1
	25	44640	20	CH ₄ : O ₂ : Ar: CO=70:23:2:5

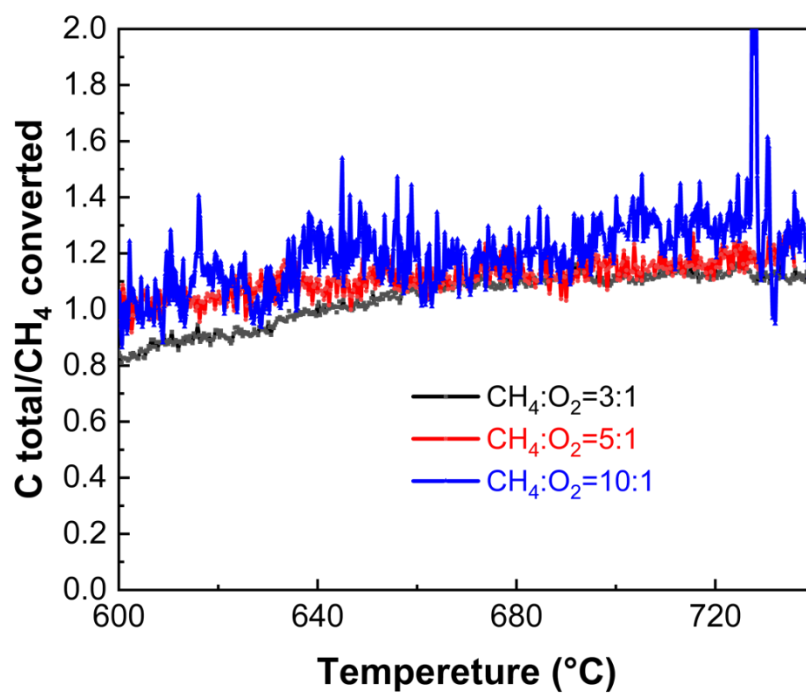


Figure S1. Carbon balance on La₂O₃ catalyst by cofeeding 3:1(black),5:1(red) and 10:1(blue) CH₄ and O₂. OCM reaction conditions: 0.02 g of the catalysts under 20 mL·min⁻¹ CH₄: O₂: Ar=70:23:7, 77.5:15.5:7, 85:8.5:6.5 flow rate, GHSV= 44640 mL·g⁻¹·h⁻¹, heating rate:10 °C/min.

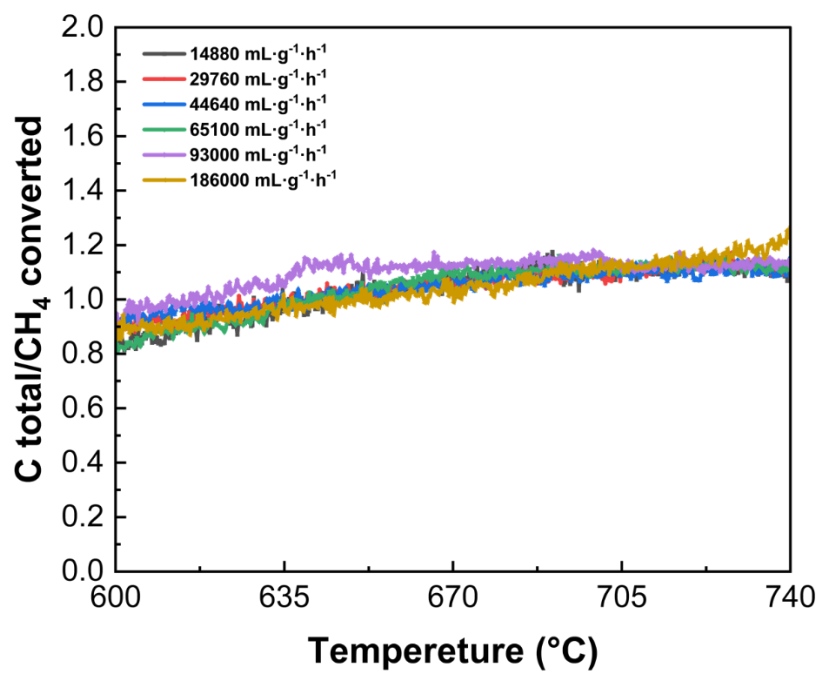


Figure S2. Carbon balance on La_2O_3 catalyst at different GHSV. The GHSV are varied from 14880 $\text{L} \cdot \text{g}^{-1} \cdot \text{h}^{-1}$ to 186000 $\text{mL} \cdot \text{g}^{-1} \cdot \text{h}^{-1}$.

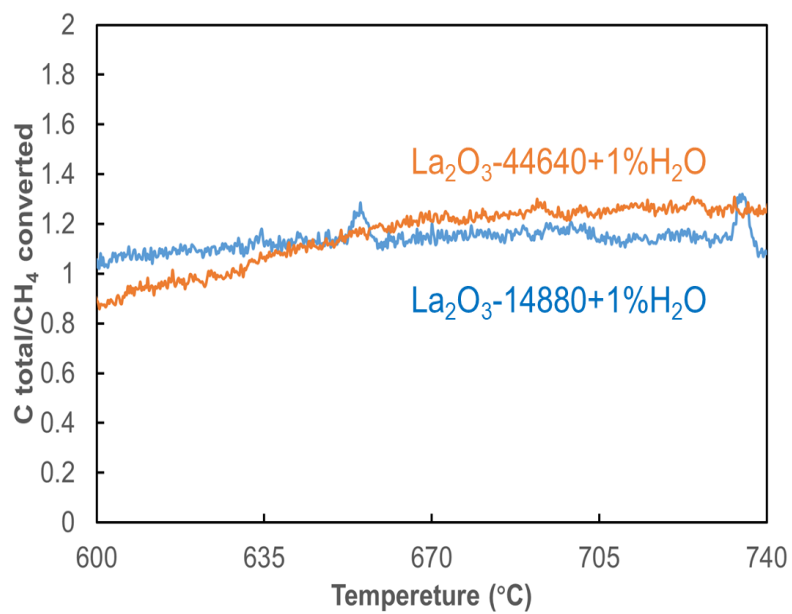


Figure S3. Carbon balance on La₂O₃ catalyst by cofeeding 3:1 CH₄ and O₂ with 1% vol H₂O at GHSV=14880 mL·g⁻¹·h⁻¹ and 44640 mL·g⁻¹·h⁻¹. OCM reaction conditions: 0.025 g of the catalysts under 6.7 and 20 mL·min⁻¹ CH₄: O₂: Ar=70:23:7 flow rate, heating rate:10 °C/min.

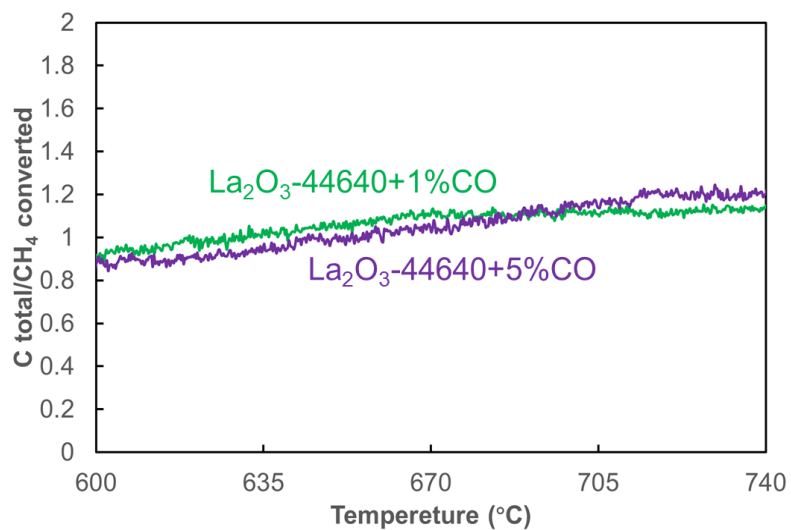


Figure S4. Carbon balance on La₂O₃ catalyst by cofeeding 3:1 CH₄ and O₂ with 1% vol CO and 5% vol CO at GHSV=44640 mL·g⁻¹·h⁻¹. OCM reaction conditions: 0.025 g of the catalysts under 20 mL·min⁻¹ CH₄: O₂: Ar: CO=70:23:6:1, 70:23:2:5, 70:23:7:0 flow rate, GHSV= 44640 mL·g⁻¹·h⁻¹, heating rate:10 °C/min.

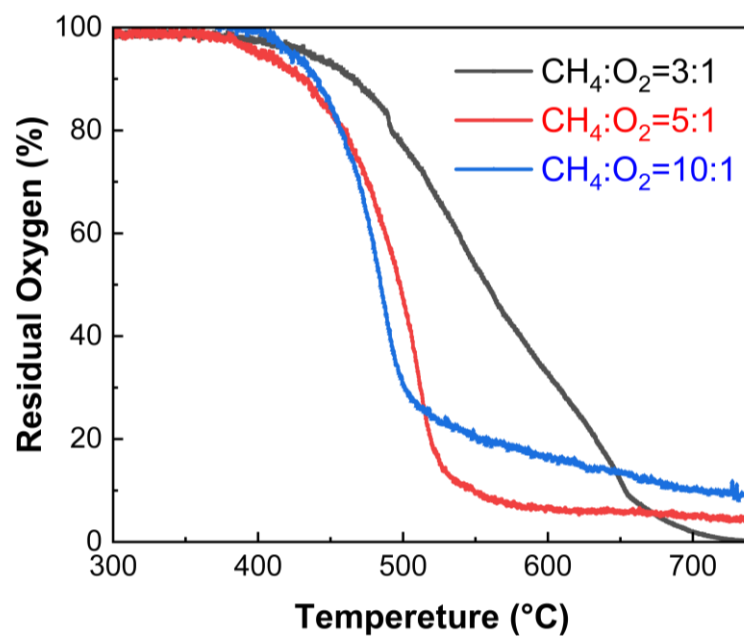


Figure S5. Oxygen consumption vs temperature of the OCM reaction over La₂O₃ catalyst by cofeeding 3:1 (black), 5:1 (red) and 10:1 (blue) CH₄ and O₂. OCM reaction conditions: 0.025 g of the catalysts under 20 mL·min⁻¹ CH₄: O₂: Ar=70:23:7, 77.5:15.5:7, 85:8.5:6.5 flow rate, GHSV= 44640 mL·g⁻¹·h⁻¹, heating rate:10 °C/min.