Electronic Supplementary Material (ESI) for Reaction Chemistry & Engineering.

Supplementary Information

High-efficiency catalytic reduction of residual oxygen for purification of carbon dioxide streams from high-pressure oxy-combustion systems

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Table S1 XRD peak shifts for $Co_{40}Mn_1$ and $Co_{20}Mn_1$ compared with pure Co_3O_4

	Before reaction		After reaction	
Peak of Co_3O_4	$2\theta = 36.8°$	$2\theta = 65.2°$	$2\theta = 36.8°$	$2\theta = 65.2°$
Shift for $Co_{20}Mn_1$	~0.1°	~0.2°	~0.15°	~0.3°
Shift for $Co_{40}Mn_1$	0°	~0.1°	~0.1°	~0.3°

Table S2 Crystallite sizes of the catalysts before and after the reaction, as estimated from the XRD analysis

Catalyst	$Co_{40}Mn_1$	$Co_{20}Mn_1$	$Cu20wt\%/Al_2O_3$	$Cu29wt\%/Al_2O_3$	$Cu58wt\%/ZnO\text{-}Al_2O_3$
Crystallite	$Co_{3-x}Mn_xO_4$	$Co_{3-x}Mn_xO_4$	Cu	Cu	Cu
Crystallite size before reaction, nm	16	15	29	29	26
Crystallite size after reaction, nm	27	28	n.a.	36	n.a.

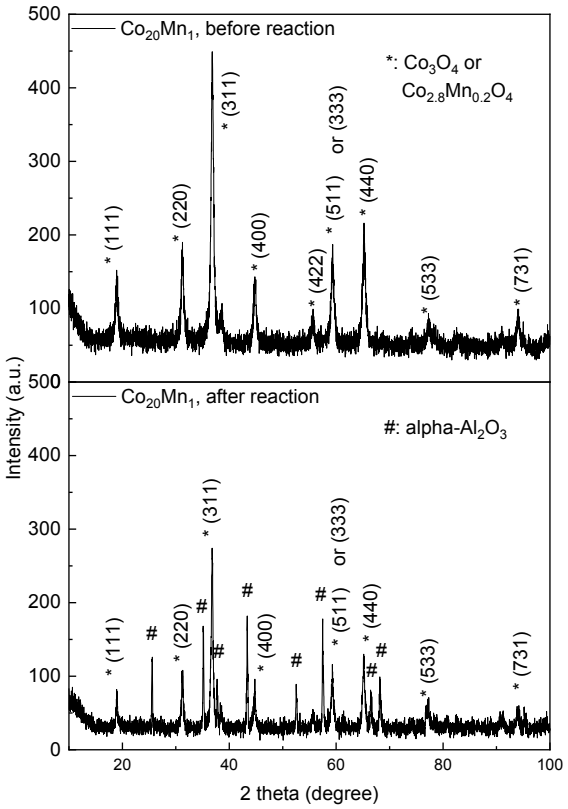

Fig. S1 X-ray diffraction patterns of $Co_{20}Mn_1$ before and after exposure to the catalytic O_2 and CH_4 reaction. (Alpha-Al_2O_3 detected in the spent catalyst after exposure to the reaction originated from mixing-contamination with heat-trapping alumina beads below and above the catalyst bed.)

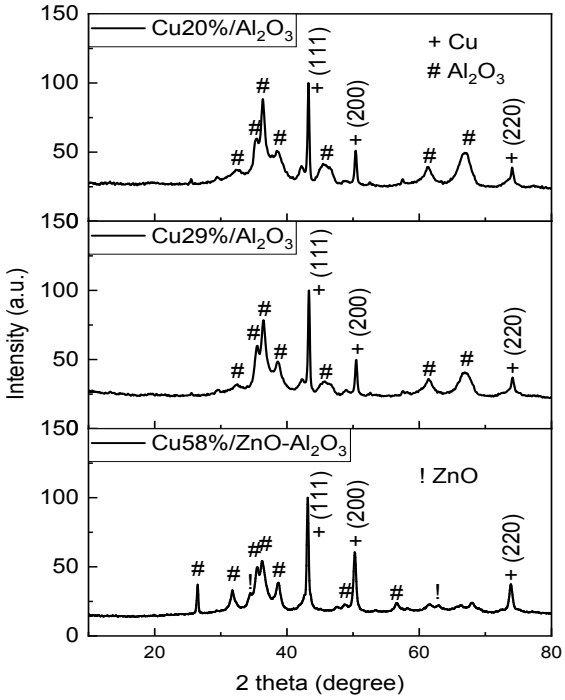

Fig. S2 X-ray diffraction patterns of Cu/Al_2O_3 catalysts before exposure to the catalytic O_2 and CH_4 reaction.

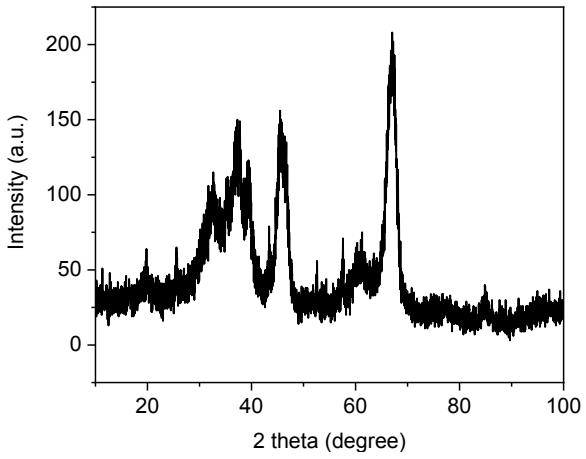

Fig. S3 X-ray diffraction pattern of the gamma-Al_2O_3 used as the Cu-based catalyst support.

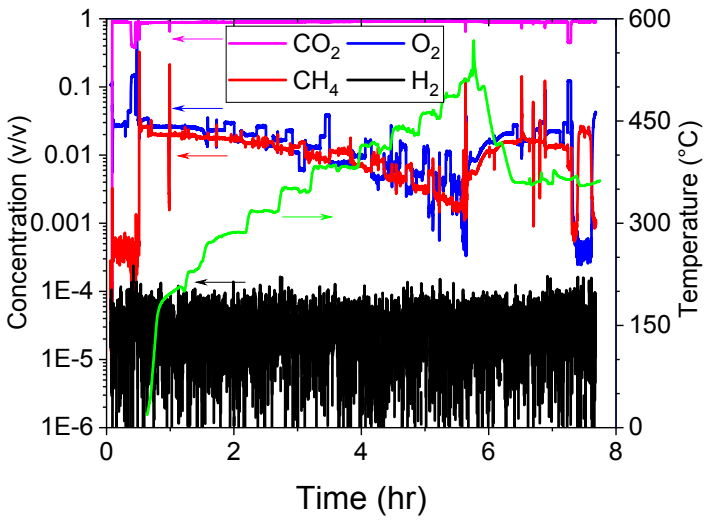

Fig. S4 Exemplary in-situ gas analysis showing that no H_2 production was detected by the RGA under various operating temperature conditions. The concentration of H_2 detected by the RGA in the initial 30 min without any CH_4 injection represented the background noise of the RGA. (Catalyst: $Co_{40}Mn_1$; Gas feed: 1.5–3.75% O_2, 1.2–2.0% CH_4 and balance CO_2; GHSV: 18,000 h^{-1}; Flow pattern: one-direction flow)