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Construction of defective cobalt oxide for methane combustion by oxygen vacancy engineering

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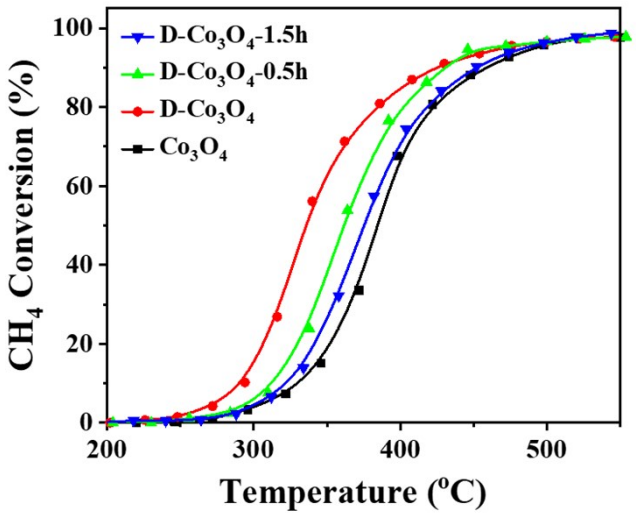

Fig. S1 Catalytic performance of D-Co_3O_4 with different milling time. Reactant mixer: 2% CH_4, 20% O_2, Ar as balance gas. WHSV=33,000 mL g^{-1} h^{-1}.

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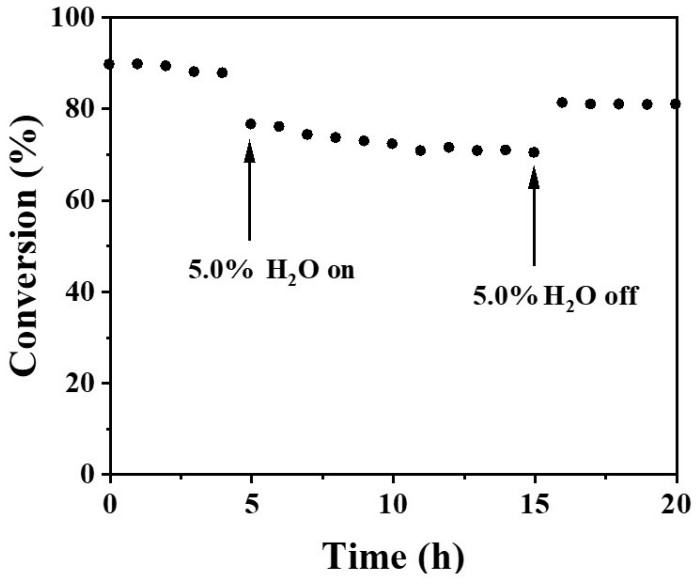

Fig. S2 Stability test of G-Co_3O_4. Reactant mixer: 2% CH_4, 20% O_2, Ar as balance gas. WHSV=33,000 mL g^{-1} h^{-1}.

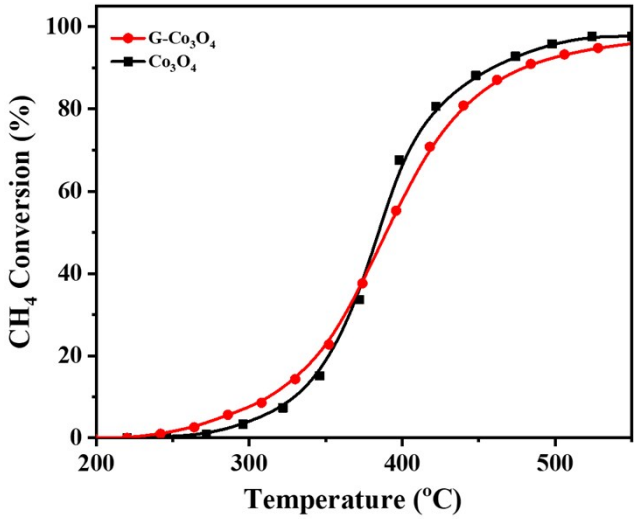

Fig. S3 Catalytic performance over Co_3O_4 and G-Co_3O_4. Reactant mixer: 2% CH_4, 20% O_2, Ar as balance gas. WHSV=33,000 mL g^{-1} h^{-1}.

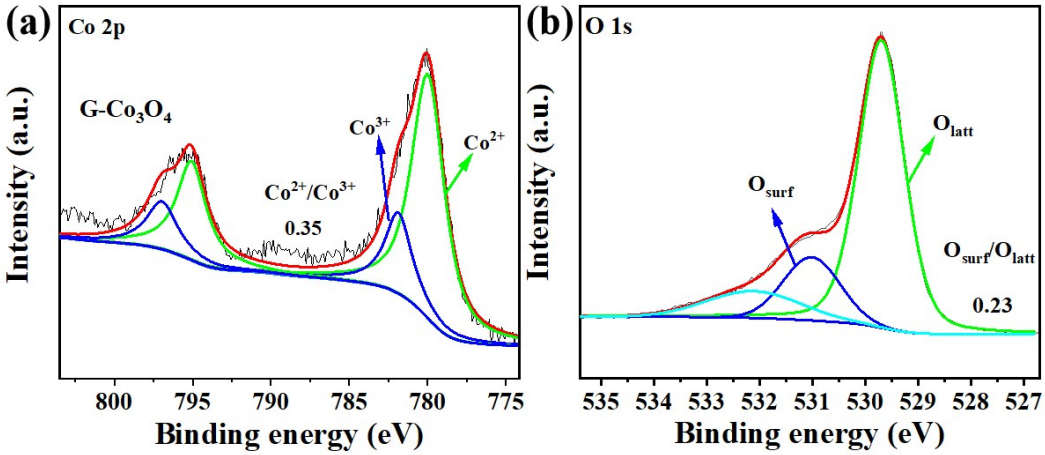

Fig. S4 Deconvolution of (a) Co 2p (b) O 1s XPS spectra of G-Co_3O_4.

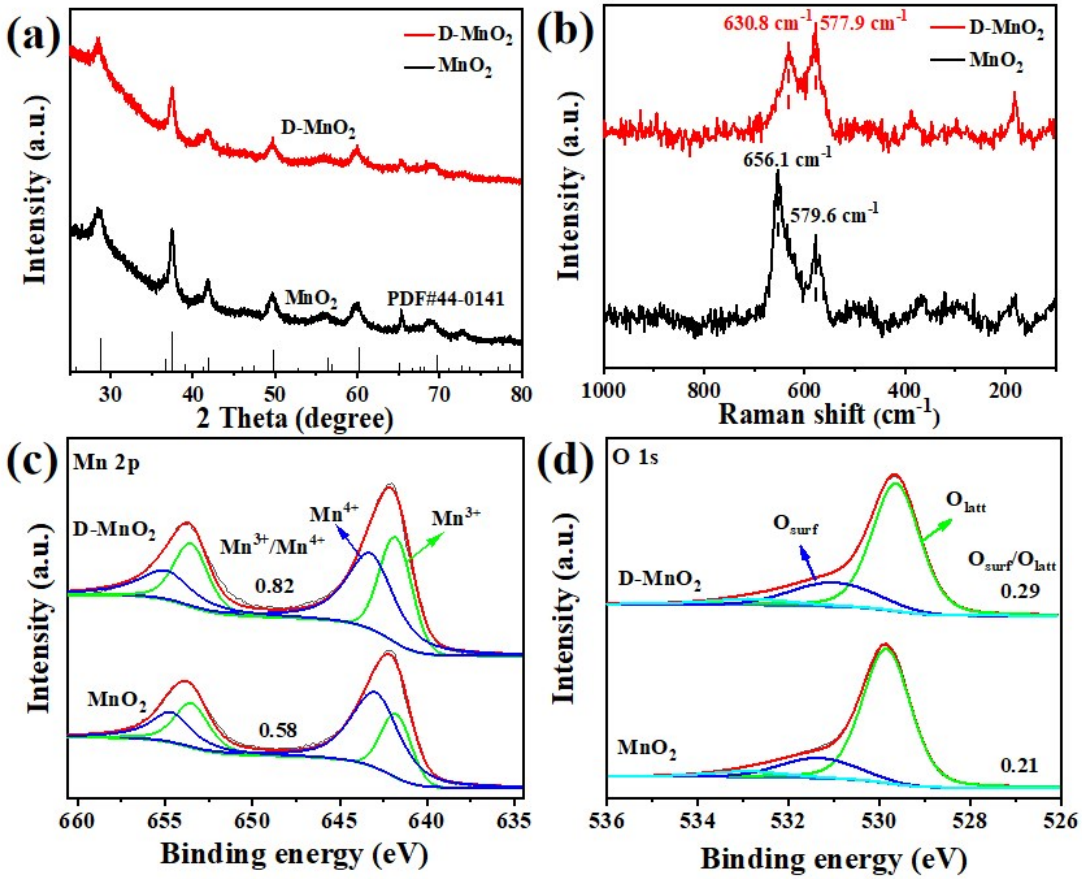

Fig. S5 (a) XRD, (b) Raman, deconvolution of (c) Mn 2p and (b) O 1s XPS spectra of D-MnO_2 and MnO_2.