Supporting Information for

A highly active Au/In_2O_3-ZrO_2 catalyst for selective hydrogenation of CO_2 to methanol

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Table S1. Comparison of Au catalysts for CO_2 hydrogenation to methanol.

Catalysts	Pressure /MPa	Temperature/ K	GHSV/ cm^3 h^{-1} g_{cat}^{-1}	X_{CO_2} / %	S_{MeOH} / %	STY/ g_{MeOH} h^{-1} g_{cat}^{-1}	Ref.
Au/In_2O_3-ZrO_2	5.0	523	21, 000	5.4	88.2	0.27	This work
Au/In_2O_3-ZrO_2	5.0	548	21, 000	10.1	83.1	0.48	This work
Au/In_2O_3-ZrO_2	5.0	573	21, 000	14.8	70.1	0.59	This work
Au/ZrO_2	5.0	573	21, 000	26.0	13.3	0.20	This work
Au/In_2O_3-ZrO_2 (3: 1)	5.0	573	21, 000	11.3	72.9	0.47	This work
Au/In_2O_3-ZrO_2 (6: 1)	5.0	573	21, 000	14.8	66.0	0.56	This work
Au/In_2O_3	5.0	573	21, 000	11.7	67.8	0.47	[1]
Au/TiO_2	0.5	513	24, 000	13.1	0.6	0.0015	[2]
Au/CeO_2	0.1	498	20, 000	~1	~37.0	0.0047	[3]
Au/ZnO	5.0	513	9, 000	1.0	70.0	0.014	[4]
Au/ZnO-ZrO_2	8.0	493	3, 300	2	100.0	0.019	[5]
Au/Al_2O_3	0.5	493	24, 000	2	3.8	0.00048	[2]

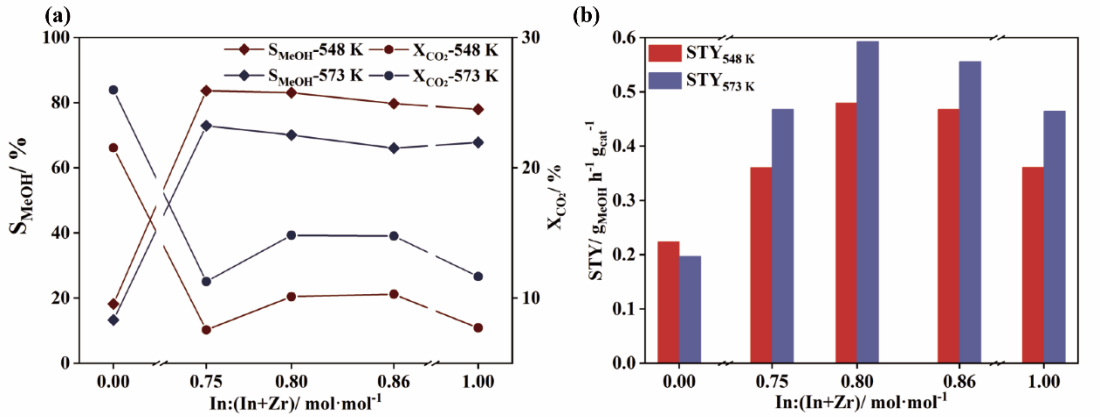

Figure S1. (a) CO_2 conversion and methanol selectivity, and (b) methanol space–time yield (STY) respect to the molar In content, which is equal to m/(m+n) for the Au/In_2O_3-ZrO_2 (m: n) sample. Reaction conditions: 5 MPa, $H_2/CO_2/N_2$ = 76/19/5, GHSV = 21,000 cm^3 h^{-1} g_{cat}^{-1}.

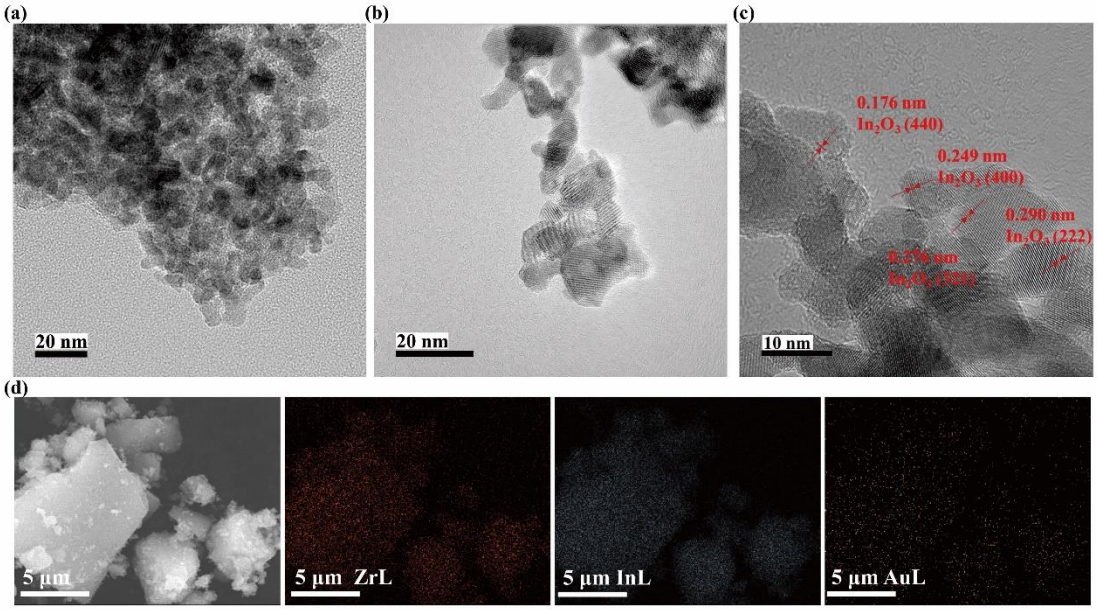

Figure S2. TEM images of Au/In_2O_3-ZrO_2 (a), Au/In_2O_3-ZrO_2-AR (b) and Au/In_2O_3-ZrO_2-AR (c); SEM image (d) and the corresponding EDX mapping of Au/In_2O_3-ZrO_2-AR.

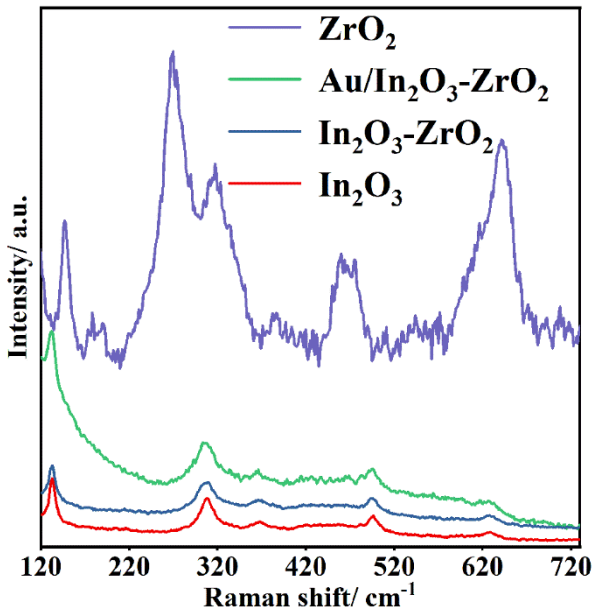

Figure S3. Visible Raman spectra of fresh ZrO_2, Au/In_2O_3-ZrO_2, In_2O_3-ZrO_2, and In_2O_3 samples.

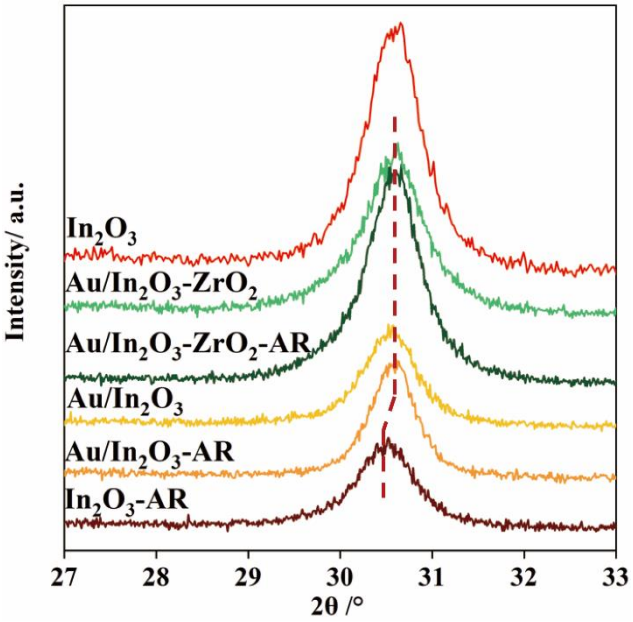

Figure S4. Enlarged XRD patterns of peaks around 32 ° for fresh samples and the samples after reaction.

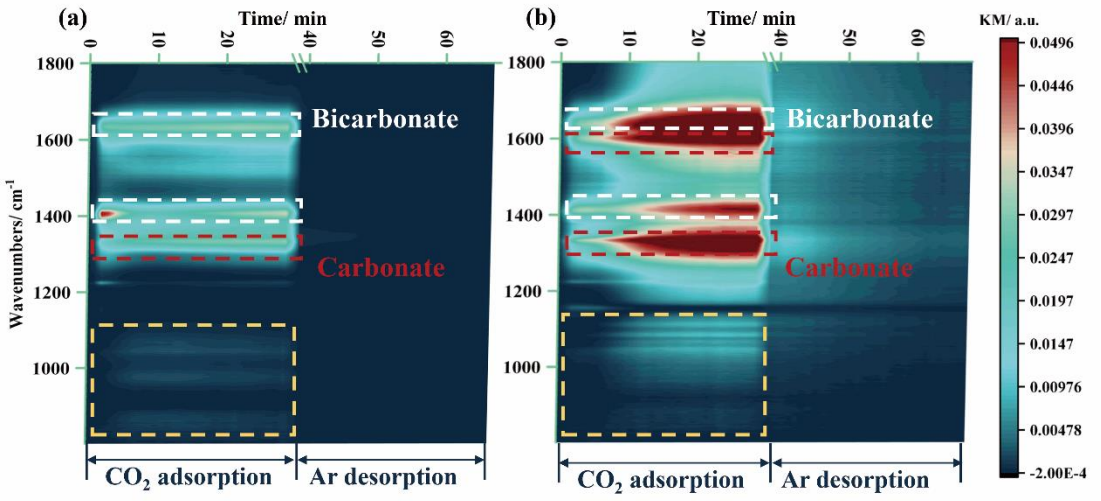

Figure S5. Time-resolved *in-situ* DRIFTS as a function of CO_2 adsorption time and Ar desorption time at 323 K after pretreatment in Ar over Au/In_2O_3 (a) and Au/In_2O_3-ZrO_2 (b). Symbol definition: bicarbonate [6] (white frame), carbonate [6-7] (red frame), CO_2 absorbed on the vacancies featuring the higher CO_2 adsorption energy [8] (yellow frame).

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