Electronic Supplementary Information (ESI)

Approaching Full-Range Selectivity Control in CO_2 Hydrogenation to Methanol and Carbon Monoxide with Catalyst Composition Regulation

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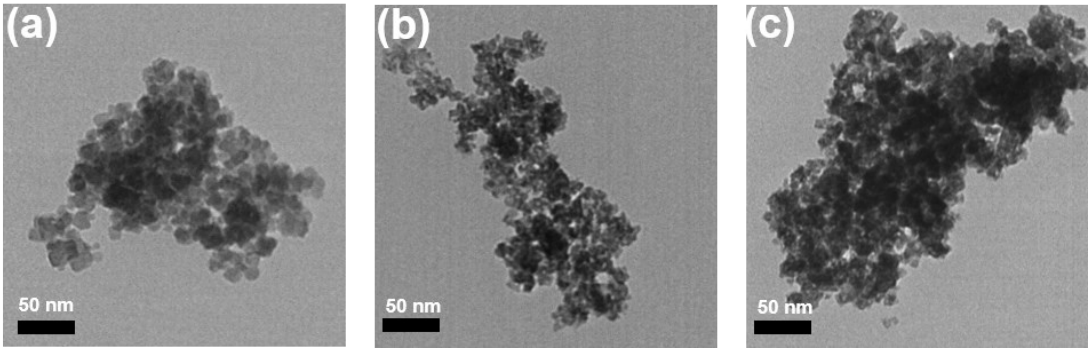

Figure S1. TEM images of P-regulated $In(OH)_3$. (a) P-In-0. (b) P-In-3. (c) P-In-3.5.

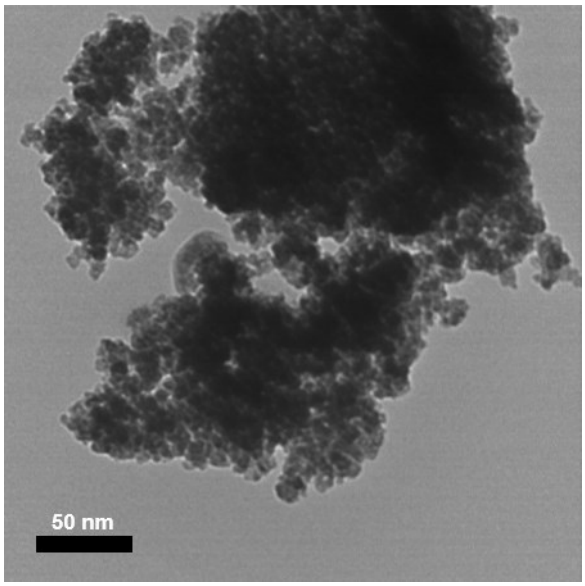

Figure S2. TEM image of P-regulated In_2O_3 (P-In-2).

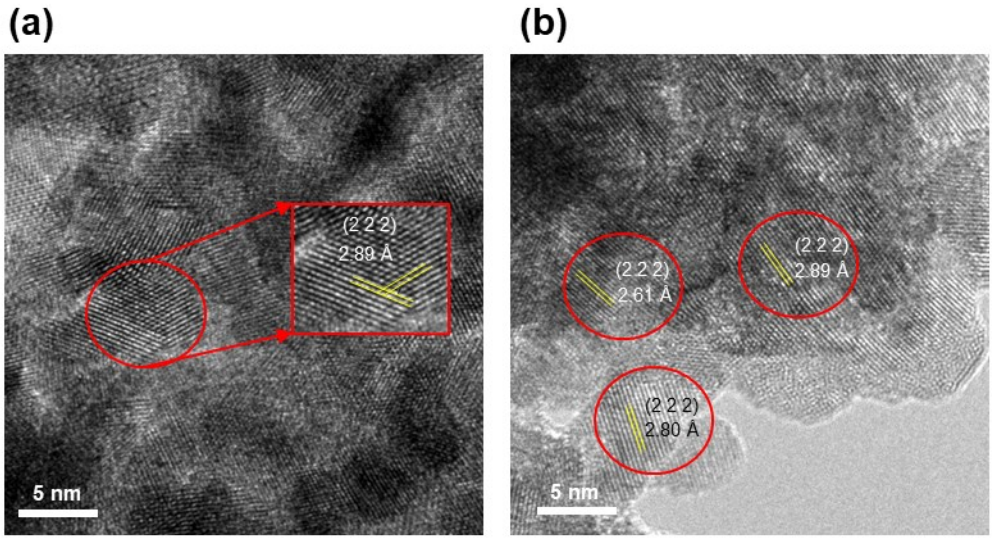

Figure S3. HR-TEM images for P-regulated materials. (a) P-In-0, (b) P-In-3.5

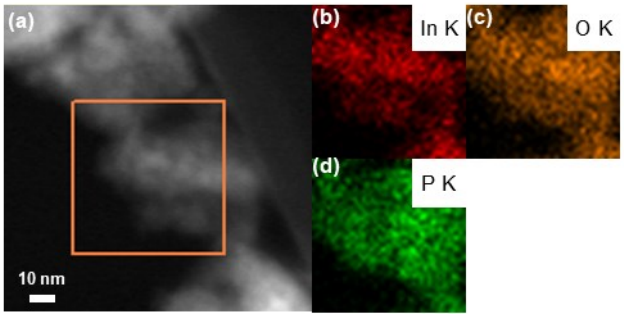

Figure S4. TEM EDX mapping images for P-regulated In_2O_3 (P-In-3.5). (a) Scanned mapping region. (b)-(d) Mapping images for In, O and P.

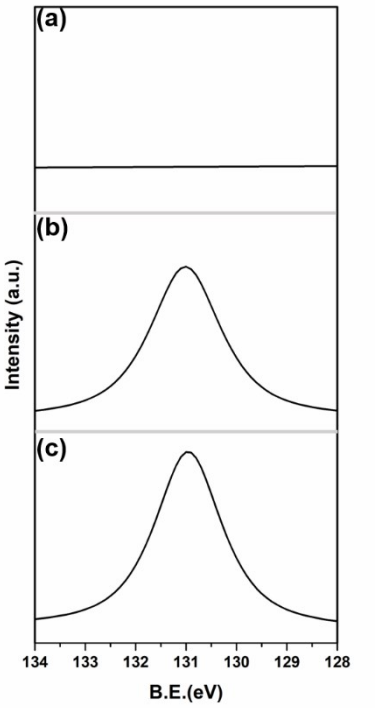

Figure S5. P 2p XPS spectra for a, P-In-0, b, P-In-2 and c, P-In-3.5 samples.

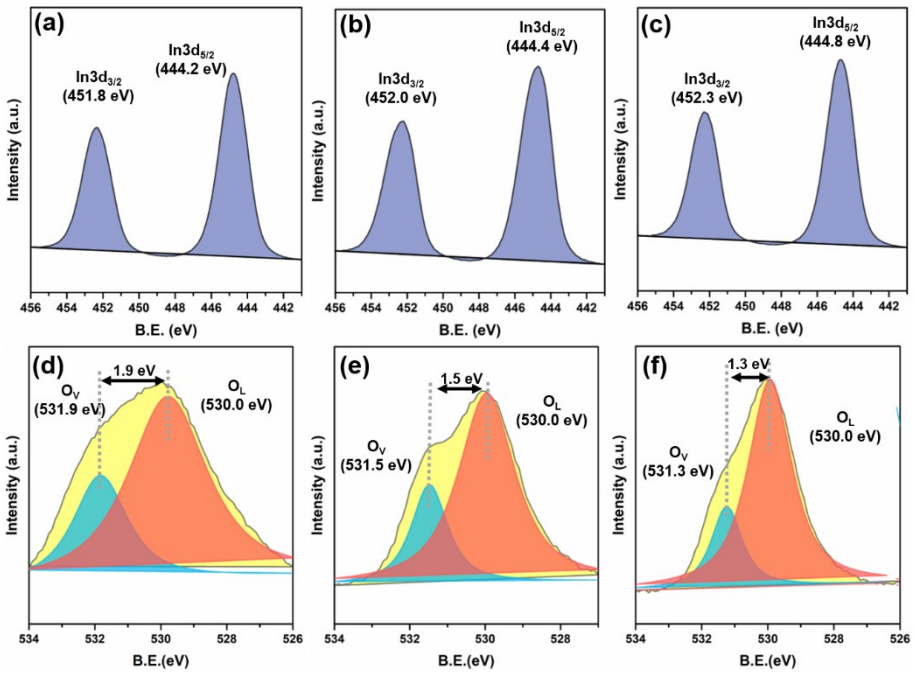

Figure S6. In 3d (a-c) and O 1s (d-f) XPS spectra for as-prepared P- regulated In_2O_3. (a,d) P-In-0, (b,e) P-In-2, (c,f) P-In-3.5.

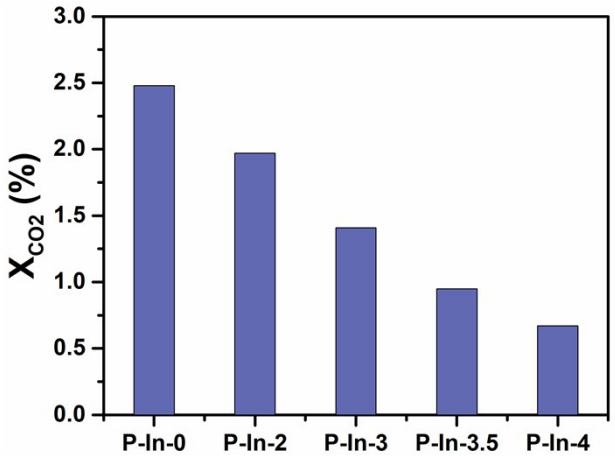

Figure S7. CO_2 conversion of In_2O_3 with varying P content. Reaction carried out at T = 300 °C, P = 30 bar and GHSV = 18000 ml/(g_{cat}·h).

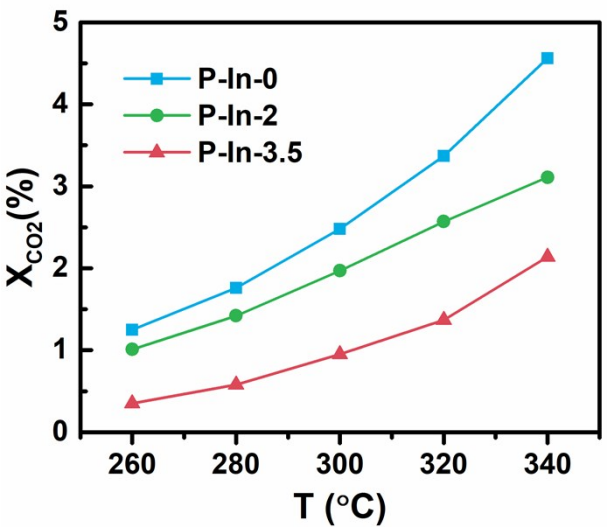

Figure S8. T-dependent CO_2 conversion (%) properties for P-In-0, P-In-2 and P-In-3.5 catalysts. Reaction carried out at P = 30 bar and GHSV = 18000 ml/(g_{cat}·h).

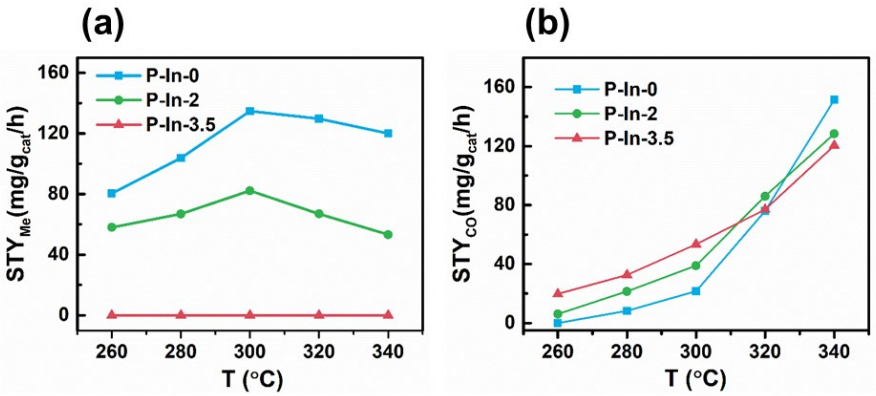

Figure S9. T-dependent space-time yield for methanol (a) and CO (b). Reaction carried out at P = 30 bar and GHSV = 18000 ml/(g_{cat}·h).

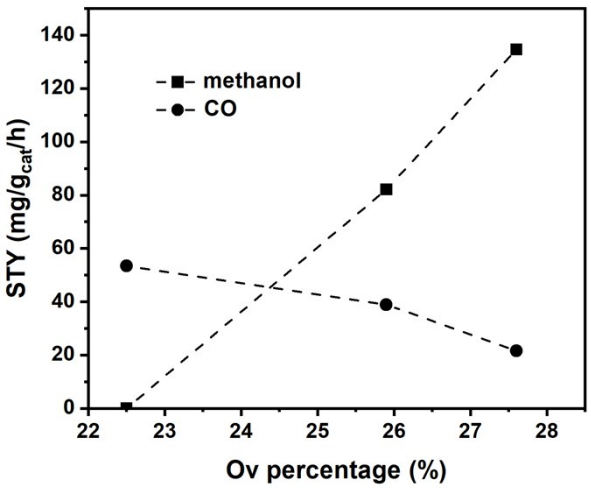

Figure S10. Relationship between abundance of oxygen vacancy (represented by Ov percentage obtained from XPS spectra) and space-time yield for methanol and CO.

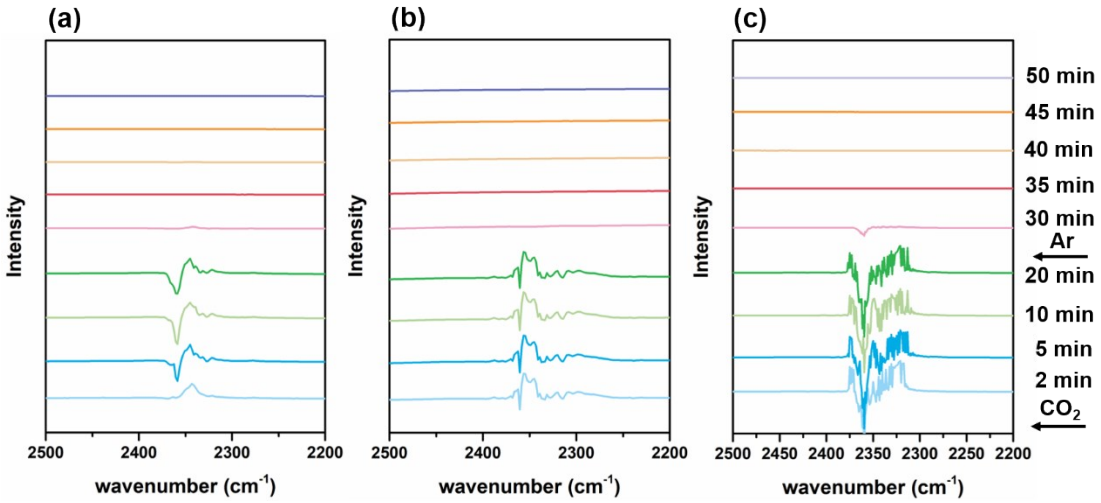

Figure S11. In situ DRIFTS spectra of CO_2 adsorption experiments on (a) P-In-0, (b) P-In-2 and (c) P-In-3.5

Table S1. Particle size of P- regulated $In(OH)_3$ and In_2O_3 obtained from XRD spectra with Scherrer equation.

P/In ratio	Particle size (nm)	
	P-$In(OH)_3$	P-In_2O_3
P-In-0	20.81	46.53
P-In-2	38.12	46.53
P-In-3	38.12	38.77
P-In-3.5	28.59	37.22
P-In-5	28.01	38.12

Table S2. Integrated area of O_V, O_L and O_{sum} obtained from XPS spectra.

	Condition	O_V		O_L		O_{sum}
		Position	Area	Position	Area	
P-In-0	Fresh	531.9 eV	5826	530.0 eV	14740	20566
	Reduced	532.4 eV	5378	530.0 eV	14105	19482
P-In-2	Fresh	531.5 eV	4382	530.0 eV	10539	15921
	Reduced	531.5 eV	4053	530.0 eV	11564	15618
P-In-3.5	Fresh	531.3 eV	4185	530.0 eV	11938	16123
	Reduced	531.3 eV	3903	530.0 eV	13447	17350