Supporting Information

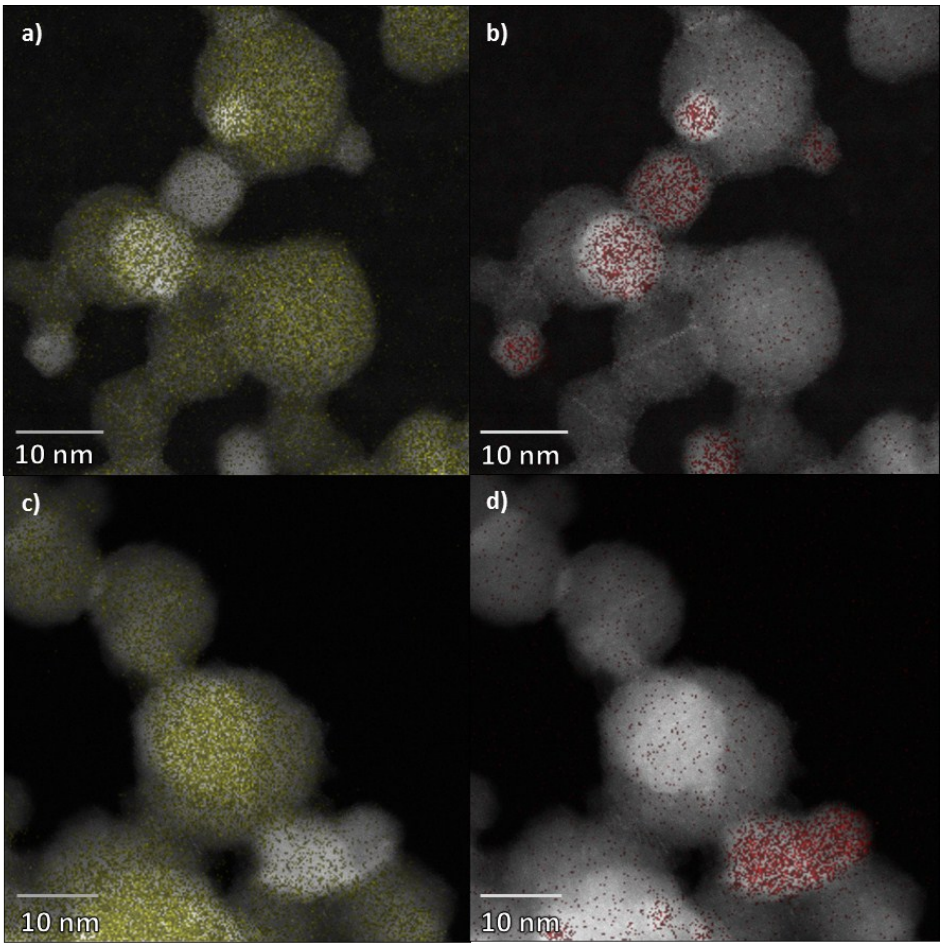

Figure S-1: TEM images of the double FSP synthesised (a, b) $CAL_{5\text{-}11}$ and (c, d) $CAL_{15\text{-}11}$ with energy dispersive X-ray spectroscopy (EDS) mapping. Red represents Co atoms and yellow represents Al atoms.

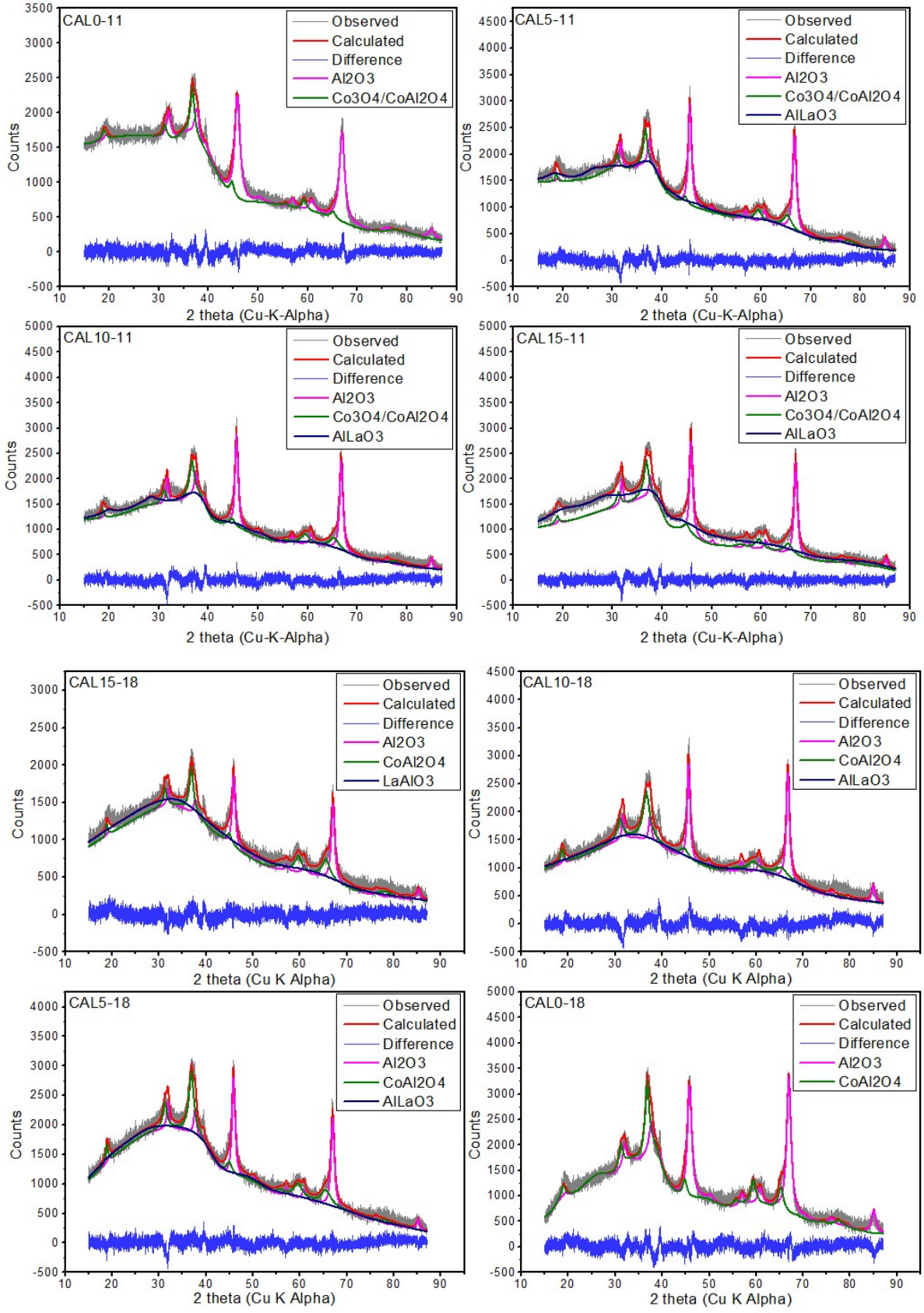

Figure S-2: X-Ray Diffraction patterns of CAL_{x-11} and CAL_{x-18} materials with Rietveld Refinement, showing the observed pattern, calculated pattern based on phase identification, and the difference between the observed and calculated pattern

Table S-1: Approximate crystallite sizes of Co_3O_4 and Al_2O_3, calculated from XRD data using the Scherrer equation or via the Rietveld Refinement

Sample	Crystallite Size (nm)		
	Co_3O_4 (Scherrer)	Al_2O_3 (Scherrer)	Al_2O_3 (Rietveld)
$CAL_{0\text{-}11}$	8.8	7.7	9.0
$CAL_{5\text{-}11}$	6.5	10.5	13.9
$CAL_{10\text{-}11}$	7.1	10.1	15.6
$CAL_{15\text{-}11}$	5.5	11.2	15.2
$CAL_{0\text{-}18}$	9.2	7.3	10.2
$CAL_{5\text{-}18}$	6.9	9.3	14.9
$CAL_{10\text{-}11}$	6.1	9.8	15.2
$CAL_{15\text{-}18}$	5.9	10.0	13.4

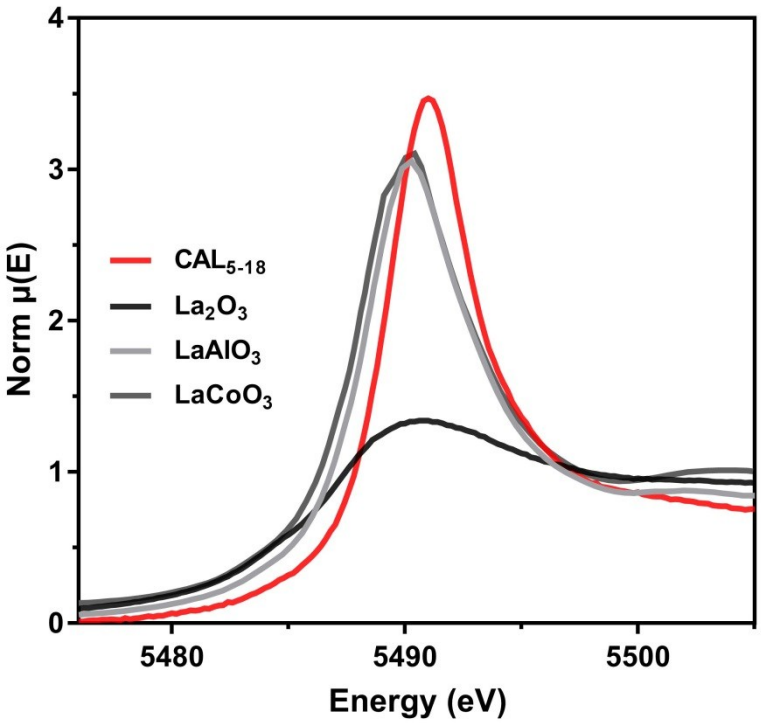

Figure S-3: La L_3-edge XANES of $CAL_{5\text{-}11}$, synthesised via double FSP, a La_2O_3 control prepared via solution combustion and $LaAlO_3$ and $LaCoO_3$ perovskites reported by Asakura et al.[1]

Table S-2: Relative reducibility of the catalyst materials according to the H_2-TPR profiles in the temperature range of 50-600 °C

Sample	Relative Reducibility#		
	δ_1	δ_2	Total
CAL_{0-11}	0.56	0.44	1.00
CAL_{5-11}	0.72	0.77	1.49
CAL_{10-11}	0.72	0.65	1.37
CAL_{15-11}	0.64	0.84	1.48
CAL_{0-18}	0.74	0.84	1.57
CAL_{5-18}	0.78	0.78	1.56
CAL_{10-11}	0.60	0.76	1.38
CAL_{15-18}	0.81	0.83	1.63

#: reducibility calculated by area under the H_2-TPR profile in the δ_1 and δ_2 region divided by the total area under the CAL_{0-11} curve below 600 °C

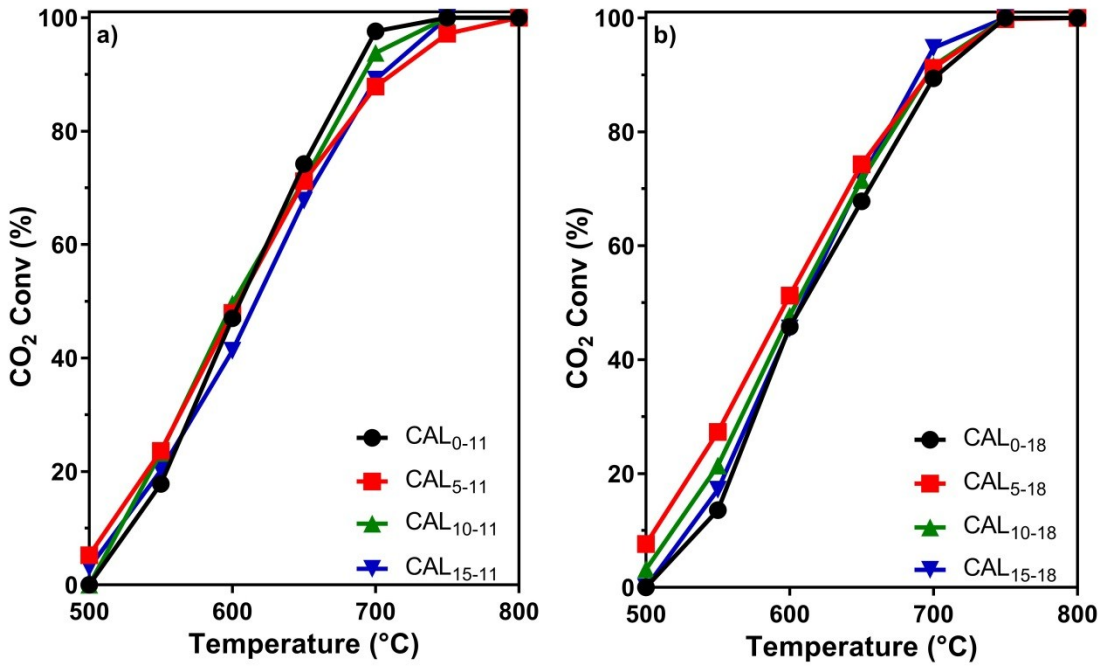

Figure S-4: CO_2 conversion as a function of temperature for the dry reforming of methane reaction with CAL_{x-y} materials prepared at nozzle distance of a) 11 cm and b) 18 cm, where x represents La content (wt %) and y represents nozzle distance. Reaction conditions: N_2:CH_4:CO_2 = 1:1:1, catalyst loading = 0.025 g, reactant gas Weight Hourly Space Velocity = 96 L/(h.g_{cat})

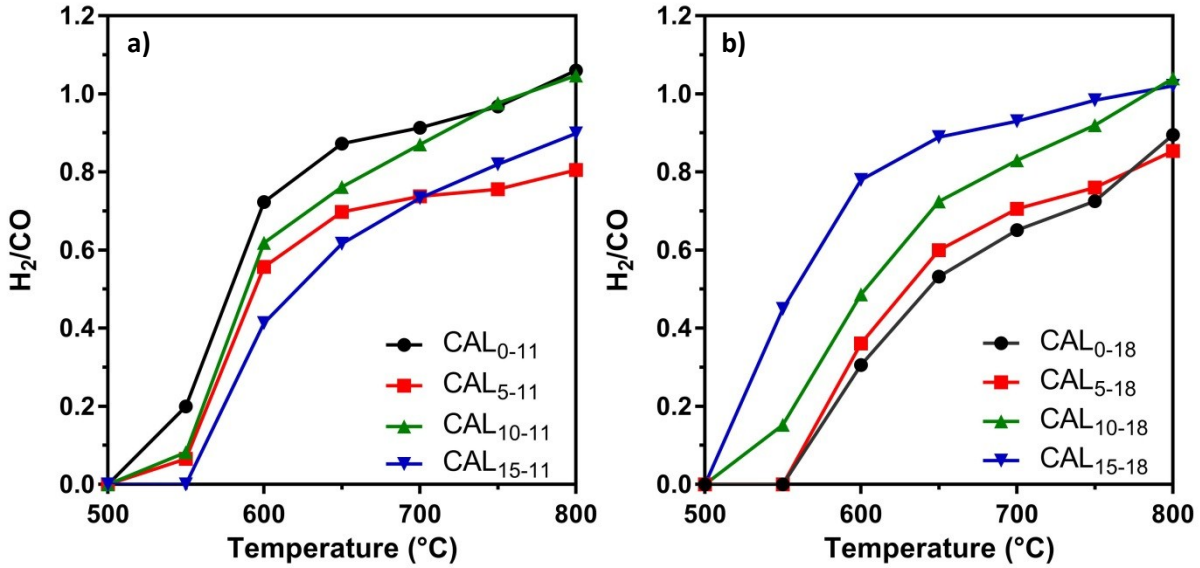

Figure S-5: H_2/CO ratio produced as a function of reaction temperature for the dry reforming of methane reaction with CAL_{x-y} materials prepared at nozzle distance of a) 11 cm and b) 18 cm, where x represents La content (wt %) and y represents nozzle distance. Reaction conditions: N_2:CH_4:CO_2 = 1:1:1, catalyst loading = 0.025 g, reactant gas Weight Hourly Space Velocity = 96 L/(h.g_{cat})

Table S-3: Summary of the WHSV of the Co-based catalysts presented in previous studies and this work, as shown in Figure 7

Author	Fig 7 Ref No	Temp (°C)	WHSV ($L.g_{cat}^{-1}.h^{-1}$)*
Özkara-Aydınoğlu, Aksoylu	39	650	60
Ruckenstein, Wang	40	700	12
Horlyck et al.	42	700/800	96
Zhang et al.	43	700	24
Wang et al.	47	750	36
Nagaoka.	48	750	12
Sajjadi et al.	49	750	24
Zhang et al.	50	800	72
Ayodele et al.	51	750	12
Taherian et al.	52	700	12
This Study	**-**	**650-800**	**96**

*: WHSV = weighted hourly space velocity – a measure of the flow of reactant gas (CH_4/CO_2) relative to catalyst sample mass

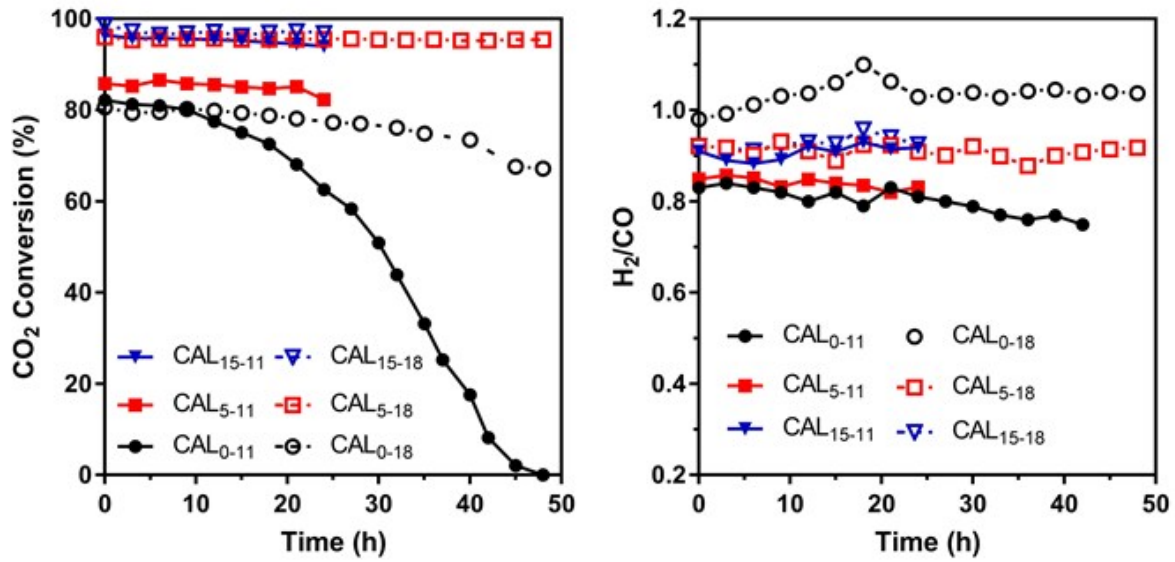

Figure S-6: CO_2 conversion (Left) and product H_2/CO ratio (Right) at nozzle distances of 11 cm and 18 cm as a function of time for the dry reforming of methane reaction at a constant temperature of 700 °C with CAL_{x-y} materials, where x represents La content (wt %) and y represents nozzle distance. Reaction conditions: N_2:CH_4:CO_2 = 1:1:1 (60 mL/min), catalyst loading = 0.025 g, reactant gas Weight Hourly Space Velocity = 96 L/(h.g_{cat})

References:

1 H. Asakura, T. Shishido, K. Teramura and T. Tanaka, *Inorg. Chem.*, 2014, **53**, 6048–6053.