Table S1. Activity and selectivity data for POM reaction over CeO_2-ZrO_2 support, Au/ZrO_2, Au/CeO_2-ZrO_2 and Au/CeO_2-TiO_2-ZrO_2 catalysts at different temperatures ranges for O_2 : CH_3OH molar feed ratio 0.5 and GHSV =30000 h^{-1} with methanol flow rate 0.52 cm^3 hr^{-1}.

Catalysts	Conversion& selectivity	Temperature (°C)							
		275	300	325	350	375	400	425	450
CeO_2-ZrO_2	O_2 Conversion	1.79	7.14	14.29	32.14	1.43	91.07	99.86	100
	CH_3OH Conversion	2.75	3.89	7.89	15.91	45.08	51.37	61.4	64.87
	H_2 Selectivity	0	0	0	0	4.59	10.52	16.46	21.69
	CO Selectivity	0	0	0	31.79	35.49	48.22	58.29	66.19
Au/ZrO_2	O_2 Conversion	7.22	17.59	32.41	59.6	75.93	85.56	91.85	96.3
	CH_3OH Conversion	12.77	18.5	33.41	44.88	48.8	49.86	57.04	65.99
	H_2 Selectivity	0	0	0	0	0	4.17	8.66	15.95
	CO Selectivity	0	0	0	9.52	24.84	41.62	57.08	68.24
Au/CeO_2-ZrO_2	O_2 Conversion	99.8	99.8	100	100	100	100	100	100
	CH_3OH Conversion	49.1	58.9	70	81.4	91.6	94.3	97	98.79
	H_2 Selectivity	31.6	44.8	57.1	68.7	75.5	68.1	63.1	57.8
	CO Selectivity	7.5	9.9	16.3	19.5	22.3	42.7	58.5	62.17
	Carbon balance	94.7	99.5	97.5	99.5	98.7	96.5	97.8	96.3
Au/CeO_2-ZrO_2-TiO_2	O_2 Conversion	99.8	99.8	99.8	100	100	100	100	100
	CH_3OH Conversion	44.7	51.4	57.4	69.4	82.2	93.6	99.2	99.44
	H_2 Selectivity	6	14.5	37.6	46.2	59.8	67.8	70.6	66.6
	CO Selectivity	1.3	3.2	7.7	13.4	21	32.3	45	57.13
	Carbon balance	94.7	92.9	97.5	94.2	92.3	93.0	93.7	96.9

Supplementary calculation for mole balance

Carbon balance (For Au/CeZrO$_x$ catalyst at 375 ^oC)

CH_3OH moles IN = 0.00021485 moles/min

O_2 moles IN = 0.000112303 moles/min

Feed ratio O_2:CH_3OH = 0.491

Reactor outlet mole balance:

Exit flow rate 50 cc/min measured by bubble flow meter.

The product mole flow rate were calculated using GC response factor to evaluate the mole fraction for each element then multiplied by the total exit flow rate. Ideal gas rate law was assumed in all the calculations.

CH_3OH moles out	=	0.000018009 moles/min
O_2 moles out	=	0.0 moles/min
H_2 moles out	=	0.00029727 moles/min
CO moles out	=	0.0000479 moles/min
CO_2 moles out	=	0.000146257 moles/min

$$Conversion\ of\ CH_3OH = \frac{Reacted\ moles\ of\ CH_3OH}{inlet\ moles\ of\ CH_3OH}\ x\ 100\% = 91.62\ \%$$

$$Selectivity\ of\ H_2 = \frac{moles\ of\ H_2\ produced}{moles\ of\ CH_3OH\ reacted\ x\ 2} x100\% = \frac{0.00029727}{(0.00021485 - 0.000018009)x2}\ x\ 100\% = 75.5\%$$

Carbon balance:

Moles of carbon IN = 0.00021485 moles/min

Moles of carbon out = 0.000018009+0.0000479+0.000146257

= 0.000212166 moles/min

$$Carbon\ balace = \frac{outlet\ moles\ of\ carbon}{Inlet\ moles\ of\ carbon}\ x\ 100\% = \frac{0.000212166}{0.00021485}\ x100\% = 98.7\%$$

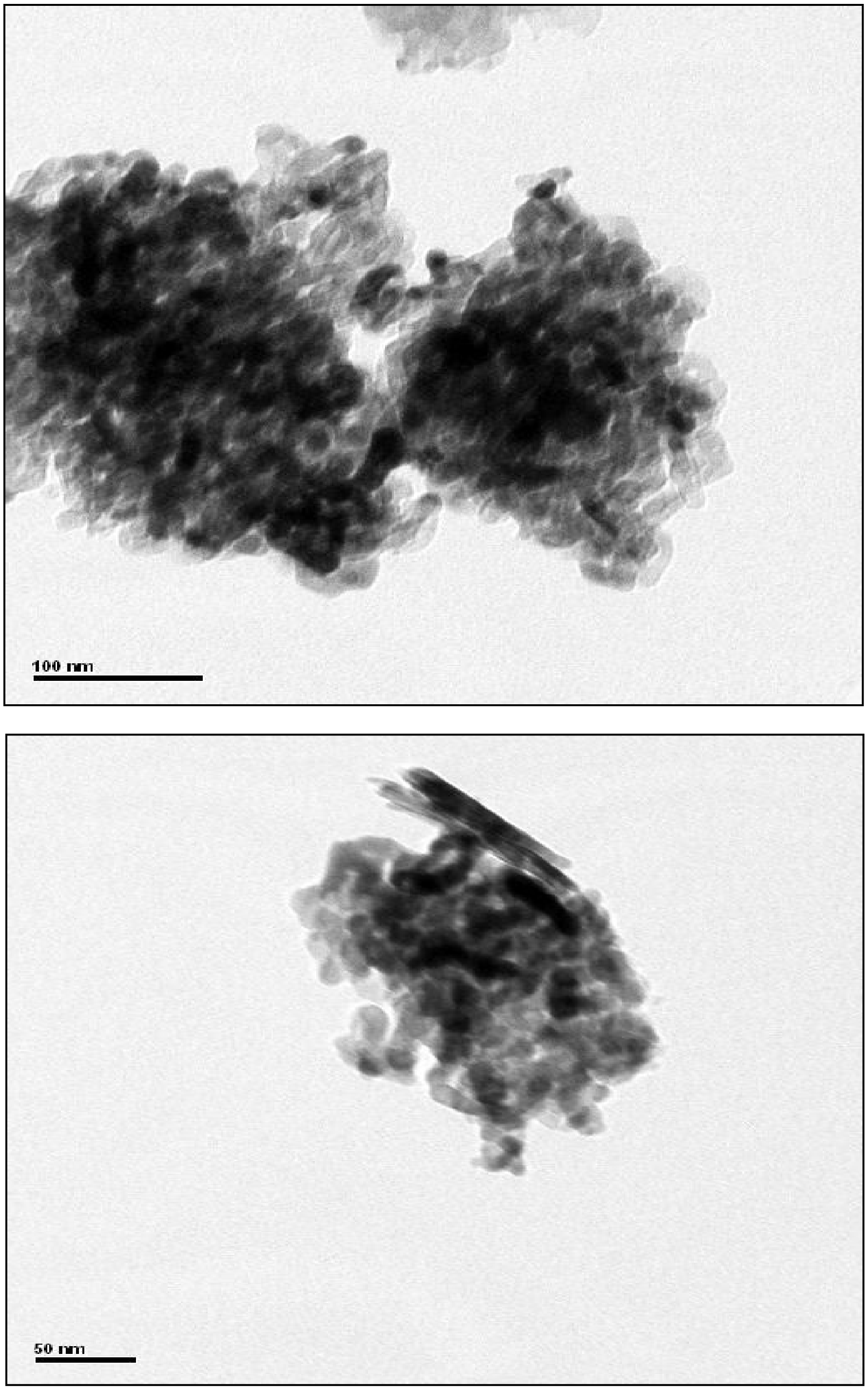

Figure S1. TEM (235KX magnification) show that the powders essentially comprised of finely divided material in the form of clusters. Each cluster consists of entangled tape-like structures, each strand being 5-10nm in width. Hence the overall material is very porous.