

Supplementary Information

1. Stability Data of Catalysts

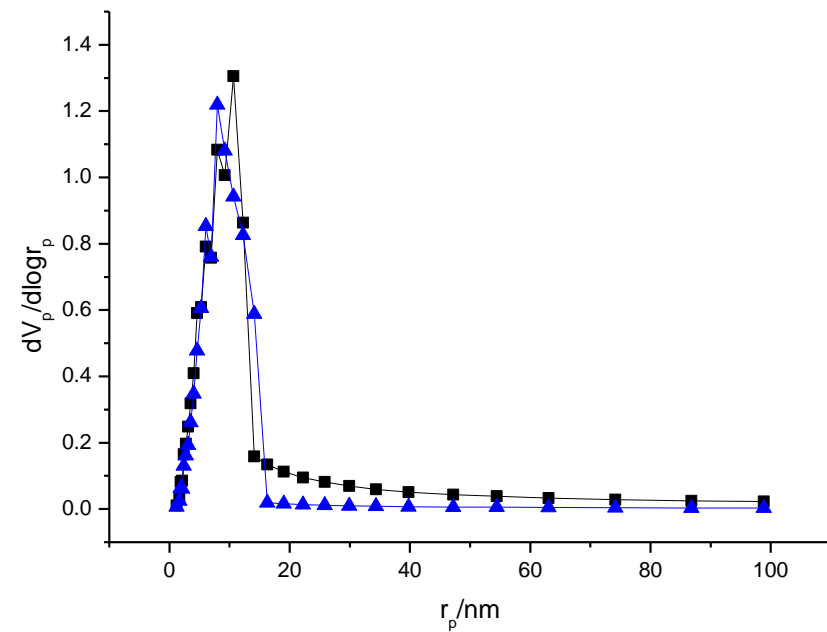
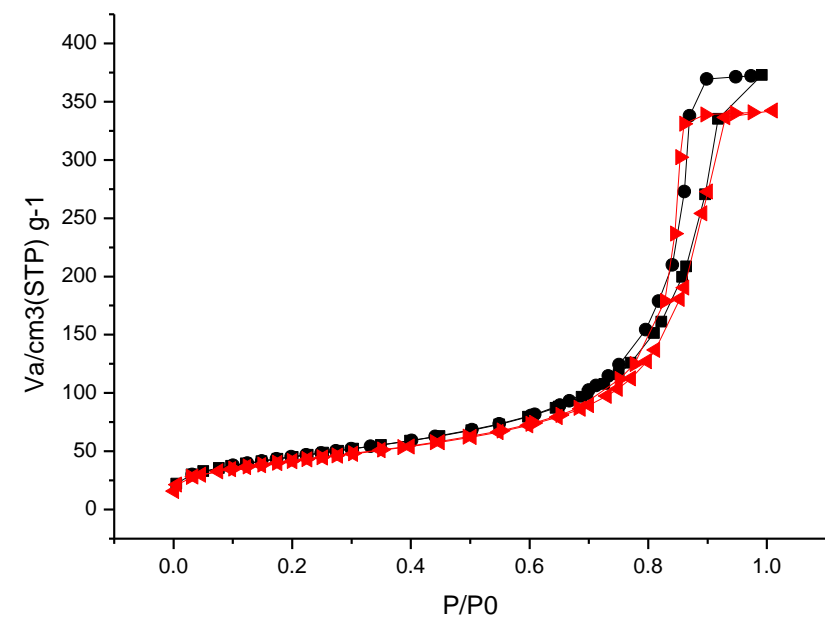
	Feed	Single Staged Reaction									
		NMA					CMA				
		1 st cycle	2 nd cycle	3 rd cycle	4 th cycle	5 th cycle	1 st cycle	2 nd cycle	3 rd cycle	4 th cycle	5 th cycle
C/H	18.8	15.8	15.8	15.9	15.8	15.8	16.1	16.0	16.1	16.2	16.1
Total S (wt%)	0.415	0.056	0.056	0.055	0.057	0.057	0.022	0.020	0.022	0.021	0.021
Total N (wt%)	1.33	0.97	0.99	0.99	0.98	0.97	0.94	0.94	0.93	0.93	0.94

*** All Cycle tests have been carried out after enough Soxhlet of catalysts**

2. Characterization of Catalysts

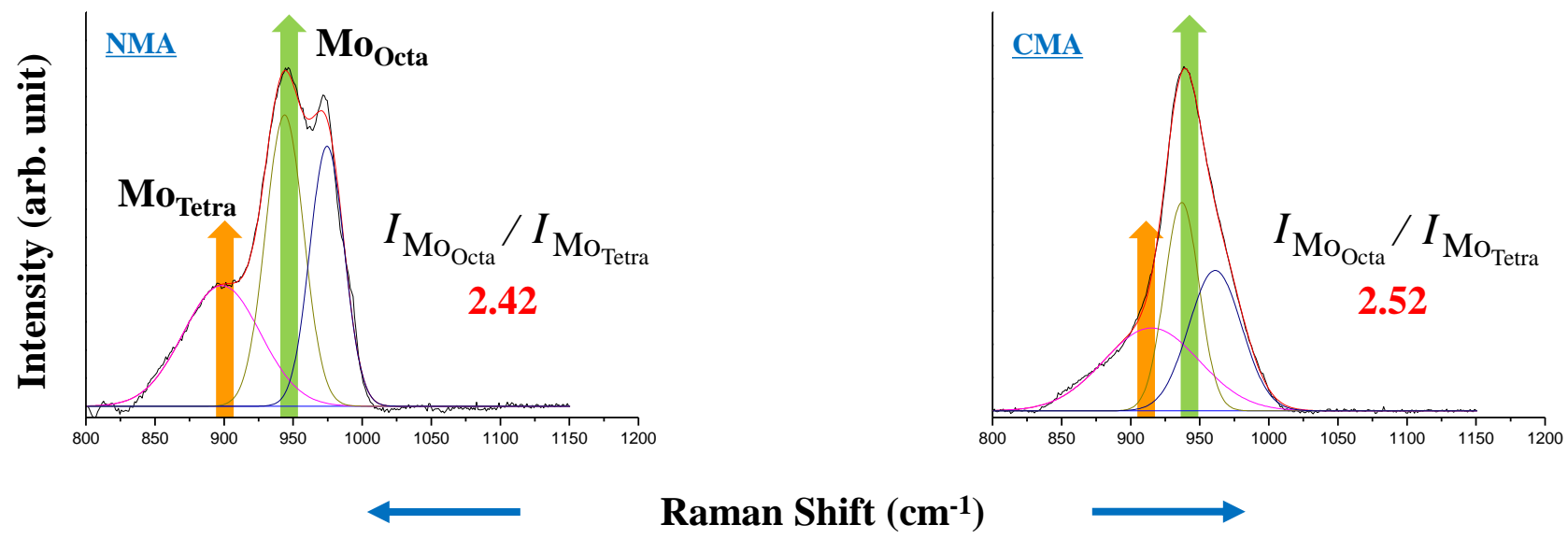
(After Sulfidation)		[Unit: %]	
		NMA	CMA
Supports	Al ₂ O ₃	63.239 (51.172)	53.116 (54.682)
	SiO ₂	-	-
Active Metals	MoO ₃	19.497 (17.732)	8.625 (12.168)
	NiO	4.594 (4.111)	-
	Co ₂ O ₃	-	2.776 (4.031)
Additives	P ₂ O ₅	2.610 (2.660)	1.918 (2.779)
	Na ₂ O	-	26.371 (-)
	SO ₃	10.060 (24.325)	7.194 (26.278)
	CaO	-	-

N₂-Sorption Isotherm on NMA and CMA

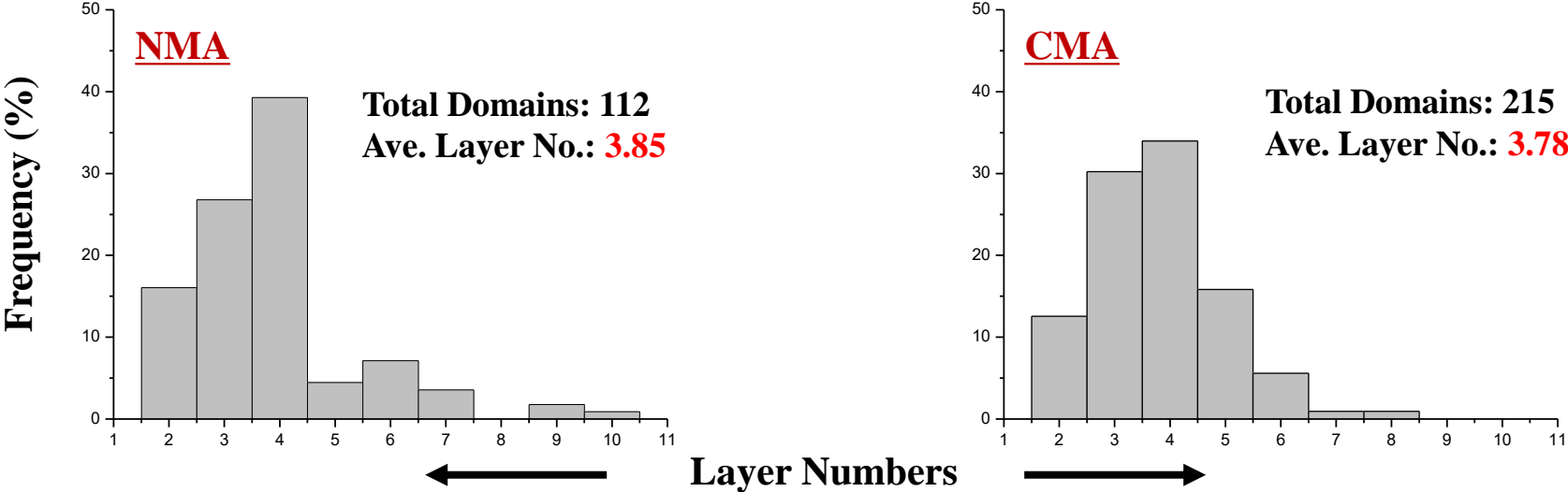


	NMA	CMA
BET Surface Area (m^2/g)	149	163
Ave. Pore Size (nm)	14.1	14.1
Total Pore Volume (m^3/g)	0.53	0.58
Ave. Pore Volume (m^3/g)	0.53	0.57

Raman Spectra on NMA and CMA



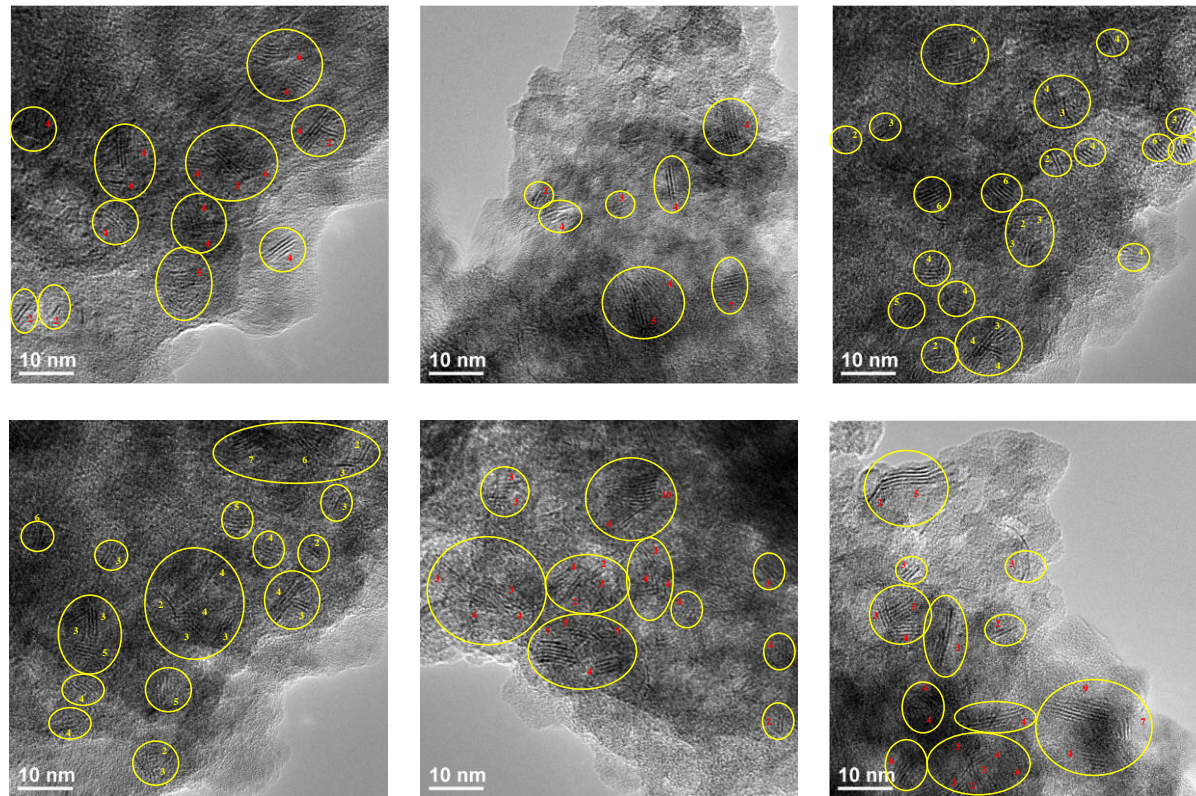
Summary of Layer Number on NMA and CMA (From TEM Images)



Layer No.	NMA		CMA	
	Counts	Frequency (%)	Counts	Frequency (%)
2	18	16.1	27	12.6
3	30	26.8	65	30.2
4	44	39.3	73	34.0
5	5	4.5	34	15.8
6	8	7.1	12	5.6
7	4	3.6	2	0.9
8	0	0.0	2	0.9
9	2	1.8	0	0.0
10	1	0.9	0	0.0
Total	215	100	215	100.0
Ave. Layers	3.85		3.78	

[Unit: mmol/g]				
	Weak Acidity	Medium Acidity	Strong Acidity	Total Acidity
	-490°C	490-770°C	770°C-	
NMA	0.89	0.17	0.01	1.07
CMA	1.01	0.14	0.01	1.16

TEM Images and Layer Number (NMA)



TEM Images and Layer Number (CMA)

