Supporting Information

Synthesis of Hierarchically Porous Silicas with Mesophase Transformations in Quadru-Component Microemulsion-Type System and the Catalytic Performance for Dibenzothiophene Hydrodesulfurization

Xiaofeng Zhou,[‡,a] Aijun Duan,[‡,a] Zhen Zhao,[*,a] Yanjun Gong,[*,b] Huadong Wu,[a] Jianmei Li,[c] Yuechang Wei,[a] Guiyuan Jiang,[a] Jian Liu,[a] Ying Zhang[c]

[a] State Key Laboratory of Heavy Oil Processing, China University of Petroleum, Beijing 102249, P. R. China.

[b] CNPC Key Laboratory of Catalysis, China University of Petroleum, Beijing 102249, P. R. China.

[c] College of Science, China University of Petroleum, Beijing 102249, P. R. China.

∗Corresponding author: zhenzhao@cup.edu.cn and gongyj@cup.edu.cn

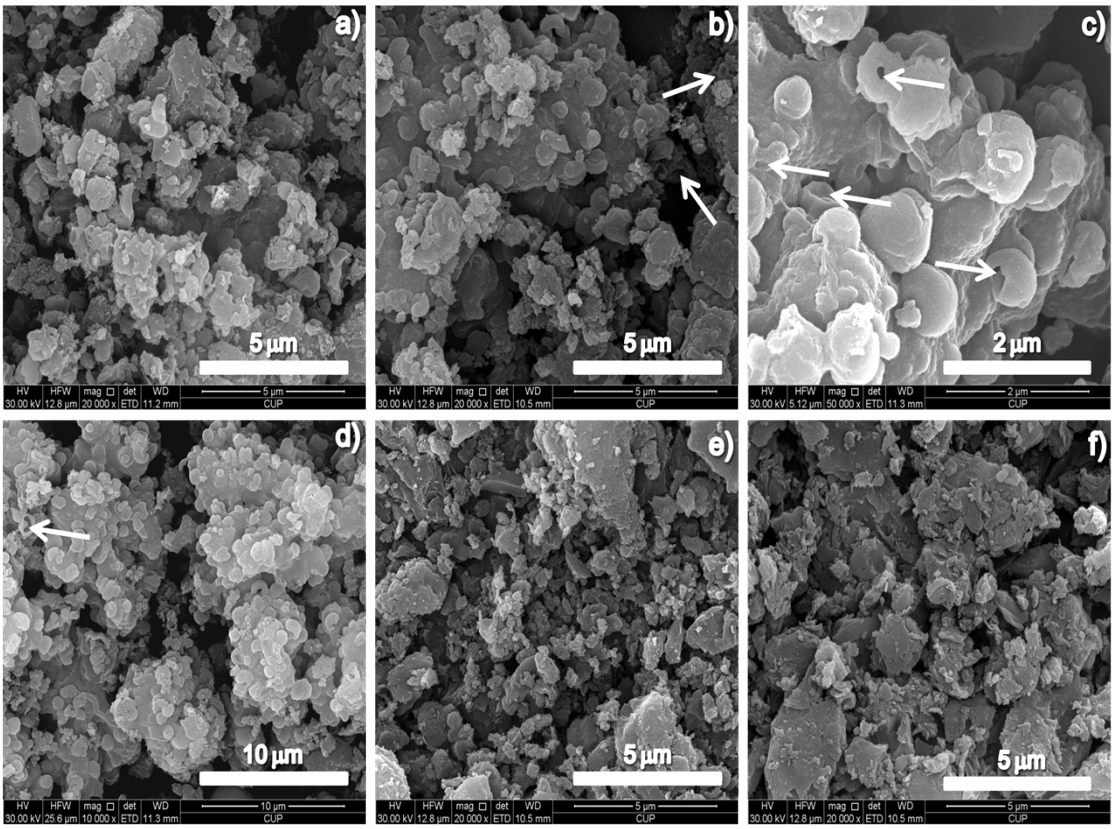

Figure S1. SEM images of calcined mesostructured silicas synthesized with different Bu/TMB molar ratios. a) MS-Bu-0, b) MS-Bu-0.5, c) MS-Bu-1, d) MS-Bu-2, e) MS-Bu-3, f) MS-Bu-4.

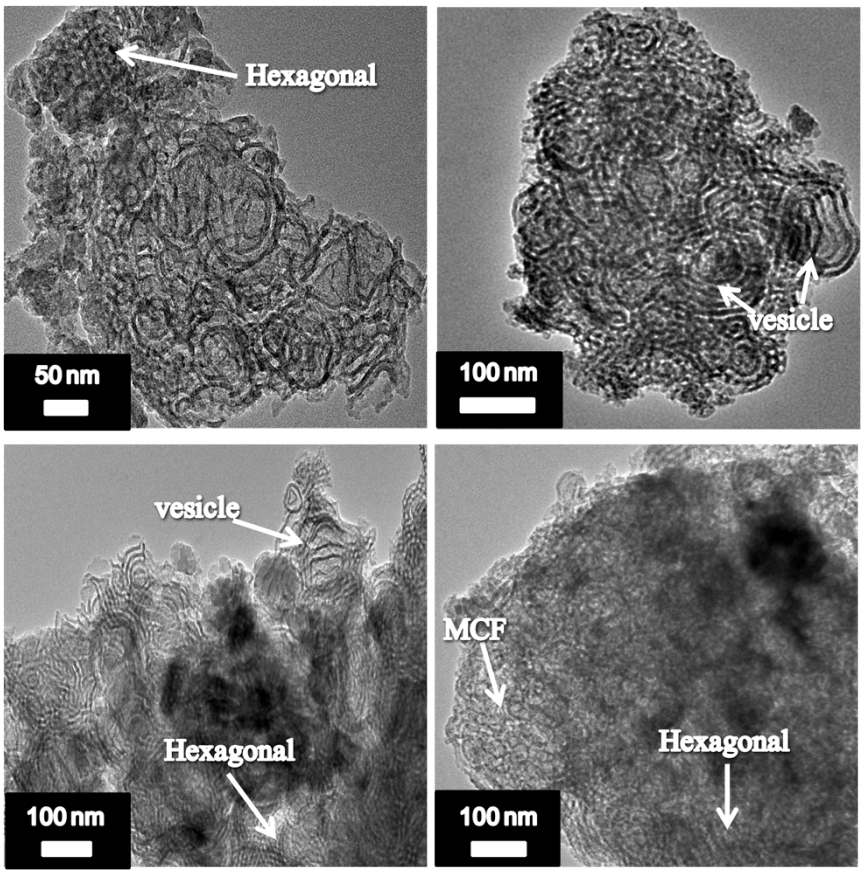

Figure S2. Representative TEM images of MS-TMB-1 calcined sample synthesized with the molar ratio TMB/Bu=1.

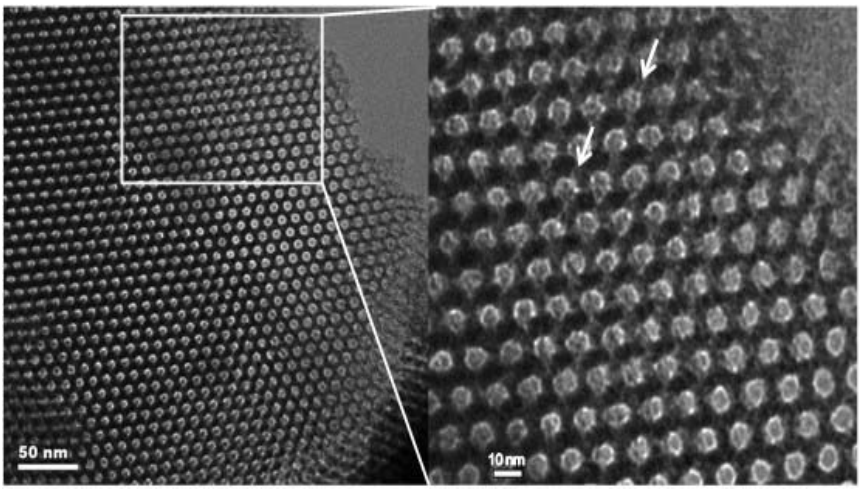

Figure S3. TEM images of the calcined sample MS-TMB-0 with the molar ratio TMB/Bu=0.

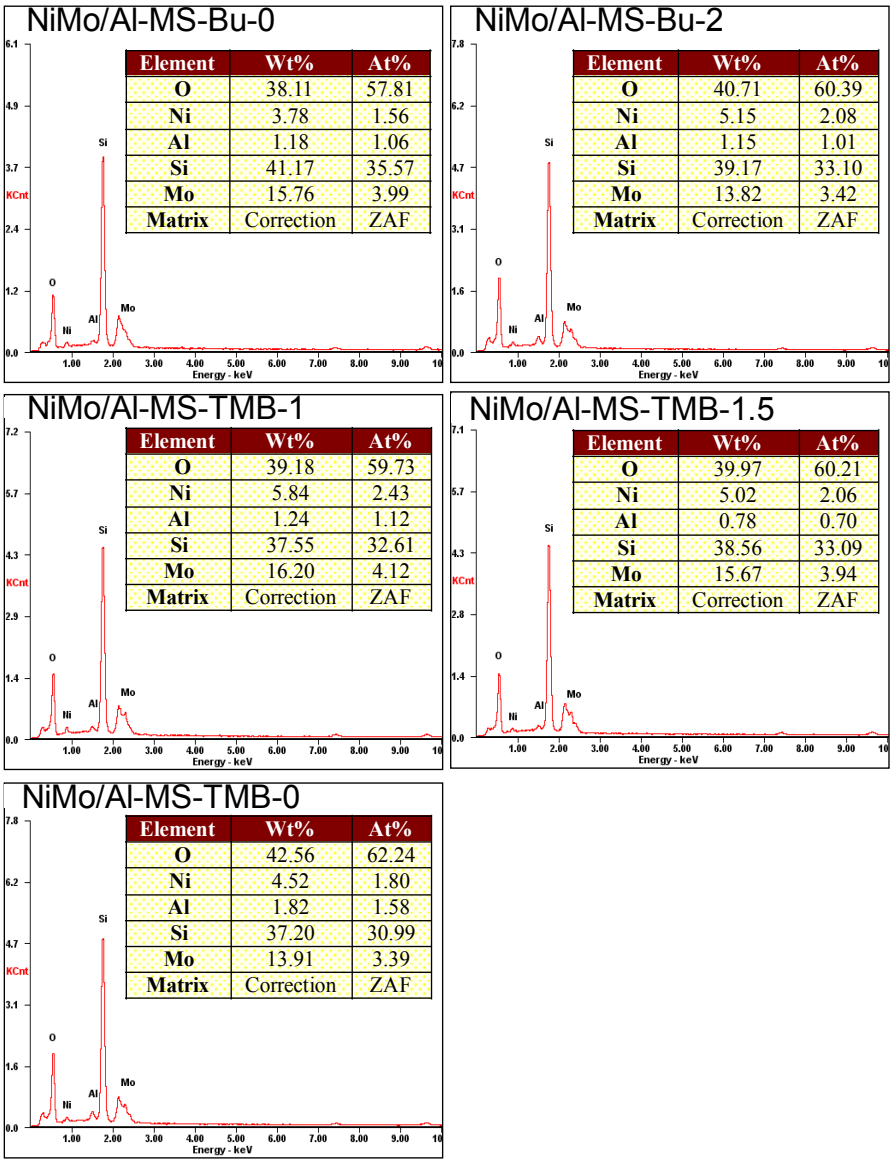

Figure S4. SEM-EDS elemental analysis results of all the prepared NiMo/Al-MS catalysts.

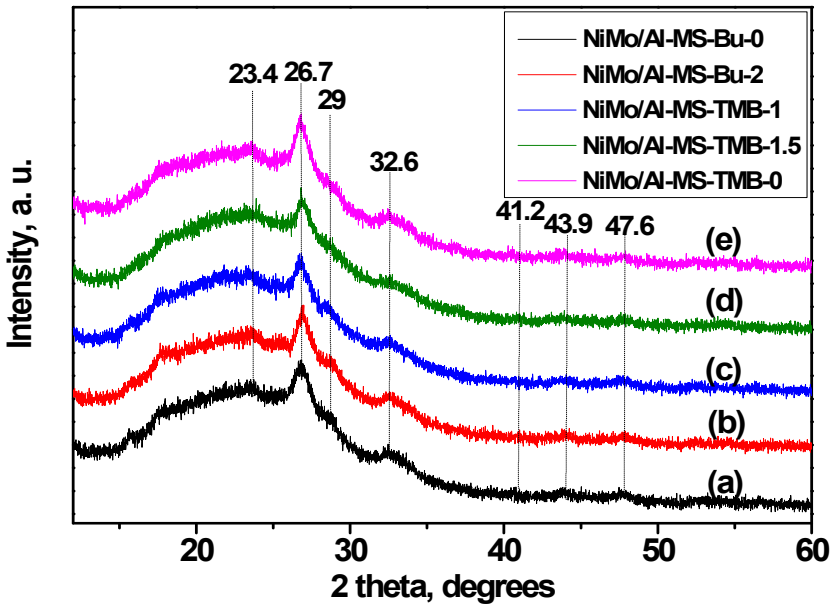

Figure S5. High angle XRD patterns of all the prepared NiMo/Al-MS catalysts. (a) NiMo/Al-MS-Bu-0, (b) NiMo/Al-MS-Bu-2, (c) NiMo/Al-MS-TMB-1, (d) NiMo/Al-MS -TMB-1.5, (e) NiMo/Al-MS-TMB-0.

Table S1. Texture parameters of the hierarchically porous silicas synthesized with different Bu/TMB molar ratios

Sample	Structure[a]	d spacing [nm][b]	BET surface area [$m^2 \cdot g^{-1}$]	Total Pore Volume [$cm^3 \cdot g^{-1}$]	t-plot [$cm^3 \cdot g^{-1}$]	Pore diameter [nm][c]
MS-Bu-0	MCF	-	624	0.91	0.14	11.5
MS-Bu-0.5	Hex+Ves	-	812	1.11	0.19	5.6, 7.7
MS-Bu-1	Hex+Ves	-	622	0.88	0.15	8.0
MS-Bu-2	Ves	-	481	1.34	0.084	5.6, 17.9
MS-Bu-3	Hex	10.9	747	0.87	0.21	8.8
MS-Bu-4	Hex	10.6	693	0.73	0.21	7.8

[a] For the structure of materials, "Hex" represents "hexagonal", "Ves" denotes "vesicle" and "MCF" stands for "mesocellular foam".

[b] The d-spacing values were calculated from the prime peak in Figure 1.

[c] Determined from the adsorption branch on the basis of BJH model.

Table S2. Texture parameters of the hierarchically porous silicas synthesized with different TMB/Bu molar ratios

Sample	Structure[a]	d spacing [nm][b]	BET surface area [$m^2 \cdot g^{-1}$]	Total Pore Volume [$cm^3 \cdot g^{-1}$]	t-plot [$cm^3 \cdot g^{-1}$]	Pore diameter [nm][c]
MS-TMB-0	Hex	10.3	805	1.04	0.14	9.6
MS-TMB-0.12	Hex	10.5	654	0.97	0.17	9.8
MS-TMB-0.24	Hex	10.7	708	0.96	0.13	9.9
MS-TMB-0.38	Hex	10.8	719	0.94	0.16	10.0
MS-TMB-1	Hex+Ves+MCF	-	665	1.13	0.18	7.7, 12.6
MS-TMB-1.5	SBA+MCF	-	694	1.20	0.14	9.8, 13.2
MS-TMB-2	SBA+MCF	-	640	1.21	0.13	12.5,17.9

[a] For the structure of materials, "Hex" represents "hexagonal", "Ves" denotes "vesicle", "SBA" in the name of "disordered-SBA-15-type" "MCF" stands for "mesocellular foam".

[b] The d-spacing values were calculated from the prime peak in Figure 4.

[c] Determined from the adsorption branch on the basis of BJH model.

Table S3. The analysis results of Si/Al molar ratio by ICP-OES for the Al-MS materials

Sample	Structure[a]	Si/Al molar ratio
Al-MS-Bu-0 (Si/Al=20)	MCF	24.4
Al-MS-Bu-2 (Si/Al=20)	Ves	25.4
Al-MS-TMB-1 (Si/Al=20)	Hex+Ves+MCF	24.0
Al-MS-TMB-1.5 (Si/Al=20)	SBA+MCF	25.6
Al-MS-TMB-0 (Si/Al=20)	Hex	24.8

[a] For the structure of materials, "Hex" represents "hexagonal", "Ves" denotes "vesicle", "SBA" in the name of "disordered-SBA-15-type" "MCF" stands for "mesocellular foam".