Electronic Supplementary Material (ESI) for Reaction Chemistry & Engineering.

Synthesis, application and kinetic modeling of CeO_x-Si-CoMo catalysts for hydrodesulfurization of dibenzothiophene

Abdulkadir Tanimu[a], Saheed A. Ganiyu[a,b], Sagir Adamu[c] Khalid Alhooshani[a]*

[a]Department of Chemistry, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia.

[b]Center of Excellence in Nanotechnology, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia.

[c]Department of Chemical Engineering, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia.

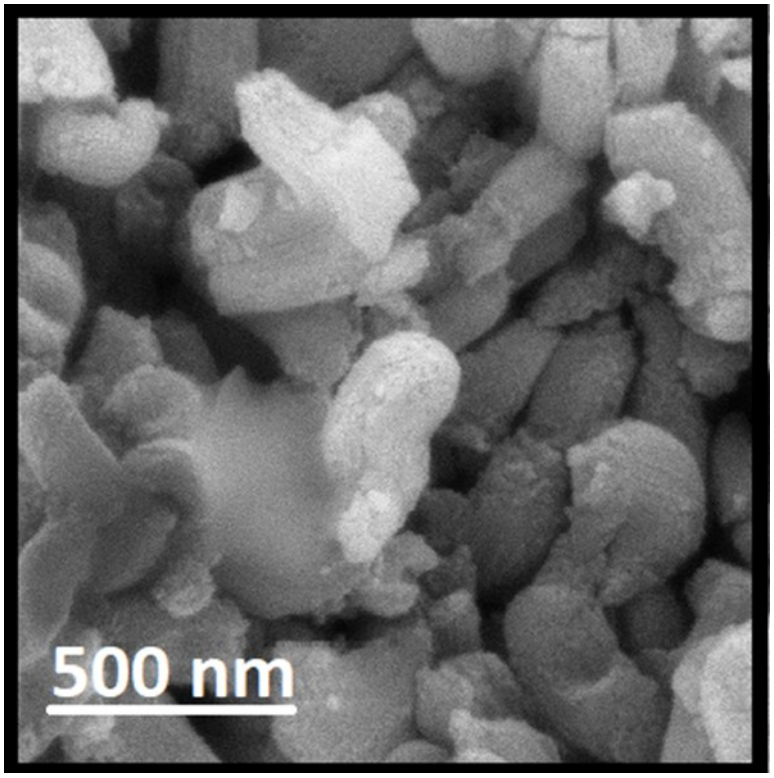

Fig. SI-1: FESEM image for Si-CoMo sulfided catalyst.

Table S1: Different types of Mo phases in the catalysts

Catalysts	**Percent molybdenum in various oxidation states**		
	Mo^{4+} ($3d_{5/2}$)	**Mo^{6+} ($3d_{5/2}$)**	**Mo^{6+} ($3d_{3/2}$)**
Binding energy	**229.5 eV**	**231.8 eV**	**235.6 eV**
Si-CoMo	11.51	58.24	30.25
1CeO_x-Si-CoMo	20.86	30.16	48.98
2.5CeO_x-Si-CoMo	33.44	44.59	21.97
5CeO_x-Si-CoMo	-	40.92	59.08
10CeO_x-Si-CoMo	-	44.16	55.84

Table S2: Effect of process temperature for 2.5CeO_x-Si-CoMo (5 MPa; DBT=1000 ppm; reaction time = 4 h).

Temperature	**Percent sulfur removal (%) at different temperature**			
(°C)	**1h**	**2h**	**3h**	**4h**
325	64.58	75.01	87.23	95.46

350	73.54	90.42	94.6	98.14
375	99.27	100	100	100

Table S3: Catalyst performance results: Product distribution (%) after 1h for 2.5CeO_x-Si-CoMo at varying temperatures (Process conditions: 5 MPa; DBT=1000 ppm).

Temp (°C)	**Product distribution (%)**				
	CPB	**CHB**	**BP**	**THDBT**	**BP/CHB**
325		14.46	85.54	-	5.92
350	-	15.53	84.47	-	5.44
375	-	16.05	83.95	-	5.23

Table S4: Effect of temperature on first-order rate constants for HDS of DBT (catalyst = 2.5CeO_x-Si-CoMo).

Temperature (°C)	**k_{HDS} x 10^3 (min^{-1})**	**k_{DDS} x 10^3 (min^{-1})**	**k_{HYD} x 10^3 (min^{-1})**	**k_{DDS}/k_{HYD}**
325	17.30	14.80	2.50	5.92
350	22.16	18.72	3.44	5.44
375	82.00	68.64	13.16	5.22