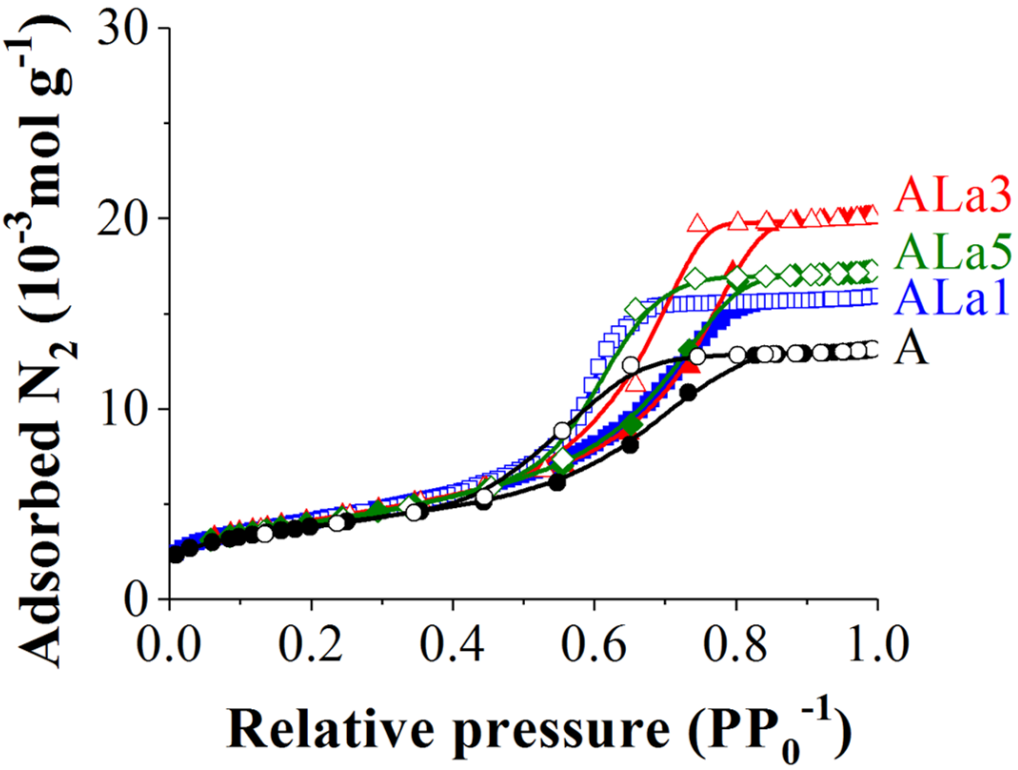


Figure S1. N_2 adsorption isotherms (at -198 °C) of sol-gel alumina support (A) and La-modified carriers at various rare earth contents (ALa*z*). Closed symbols: adsorption branch; open symbols: desorption branch.

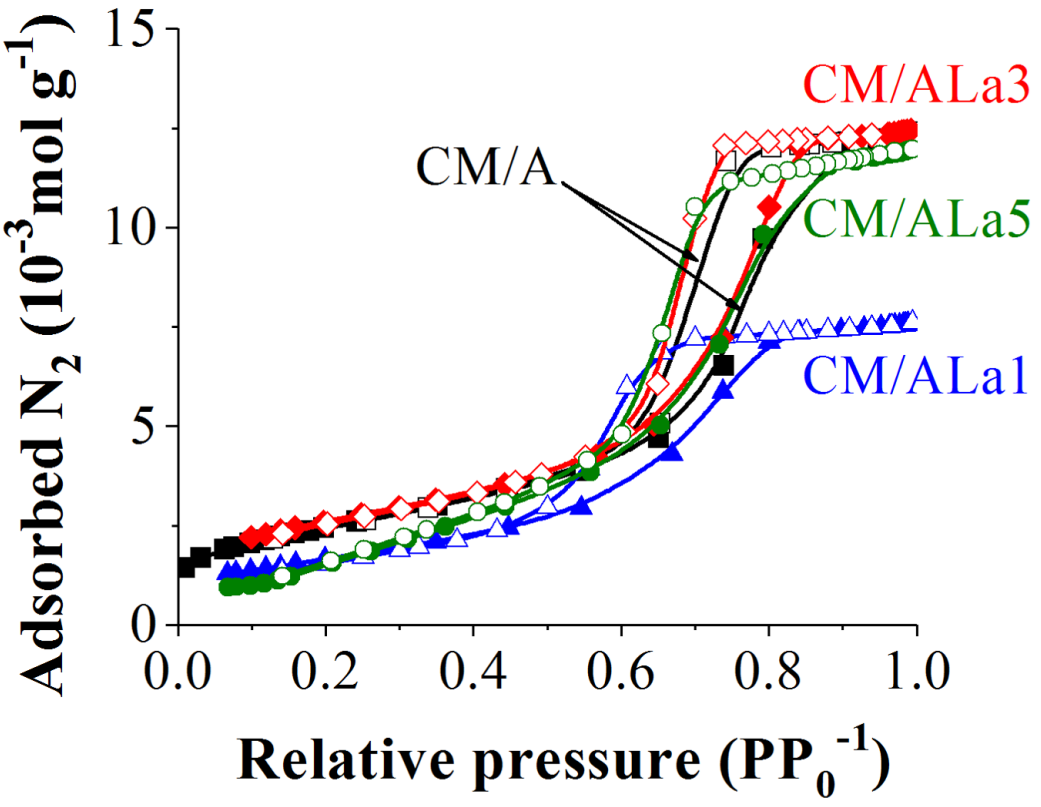


Figure S2. N_2 physisorption isotherms (at -198 °C) of oxidic P-doped CoMo materials impregnated over sol-gel alumina (A) and corresponding La-modified (ALaz) carriers. Closed symbols: adsorption branch; open symbols: desorption branch.

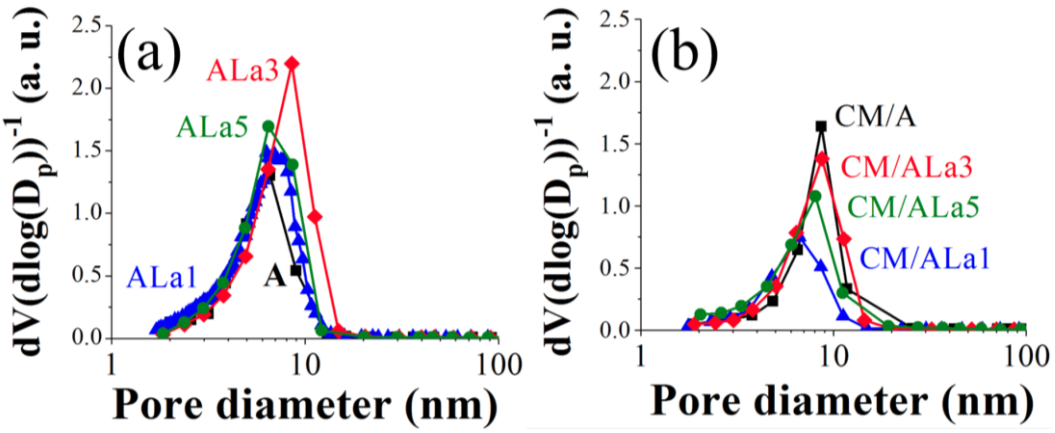


Figure S3. Pore size distributions of various prepared supports (a) and oxidic P-doped CoMo materials impregnated on sol-gel carriers at different La contents (b), as calculated by Barret-Joyner-Halenda methodology with data from adsorption branch of corresponding N_2 adsorption isotherms.

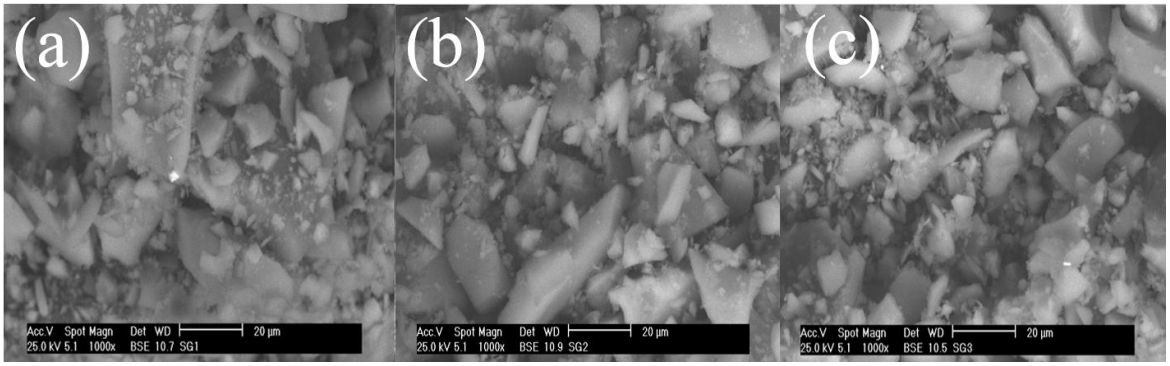


Figure S4. SEM micrographs of sol-gel La-modified supports. 1000× magnification, back-scattered electrons detector. (a): ALa1: (a); (b): ALa3; (c): ALa5.

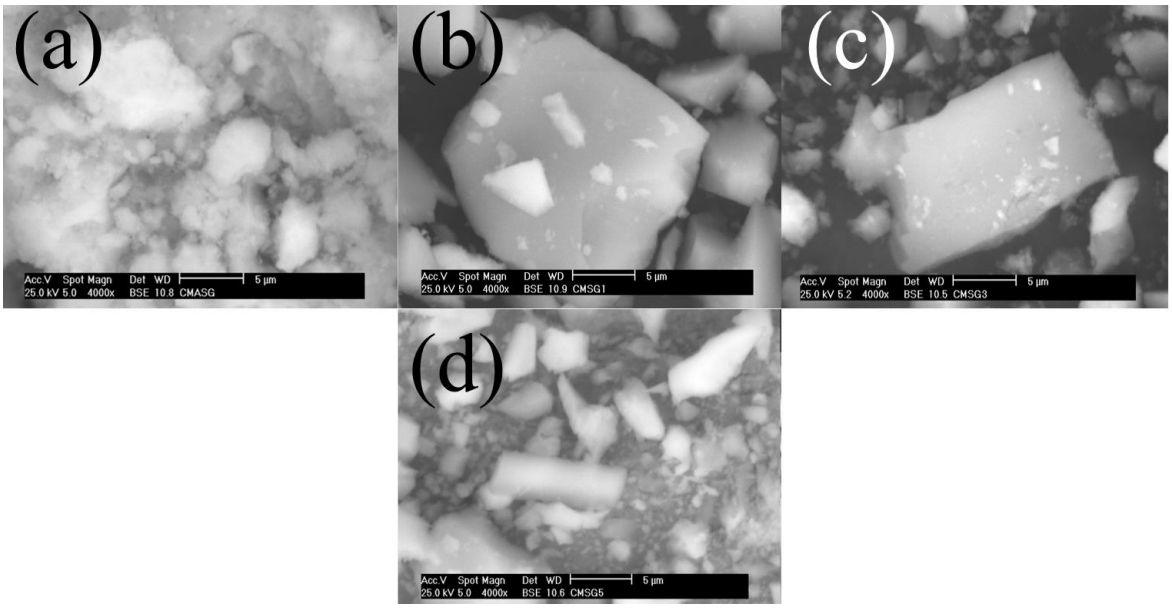
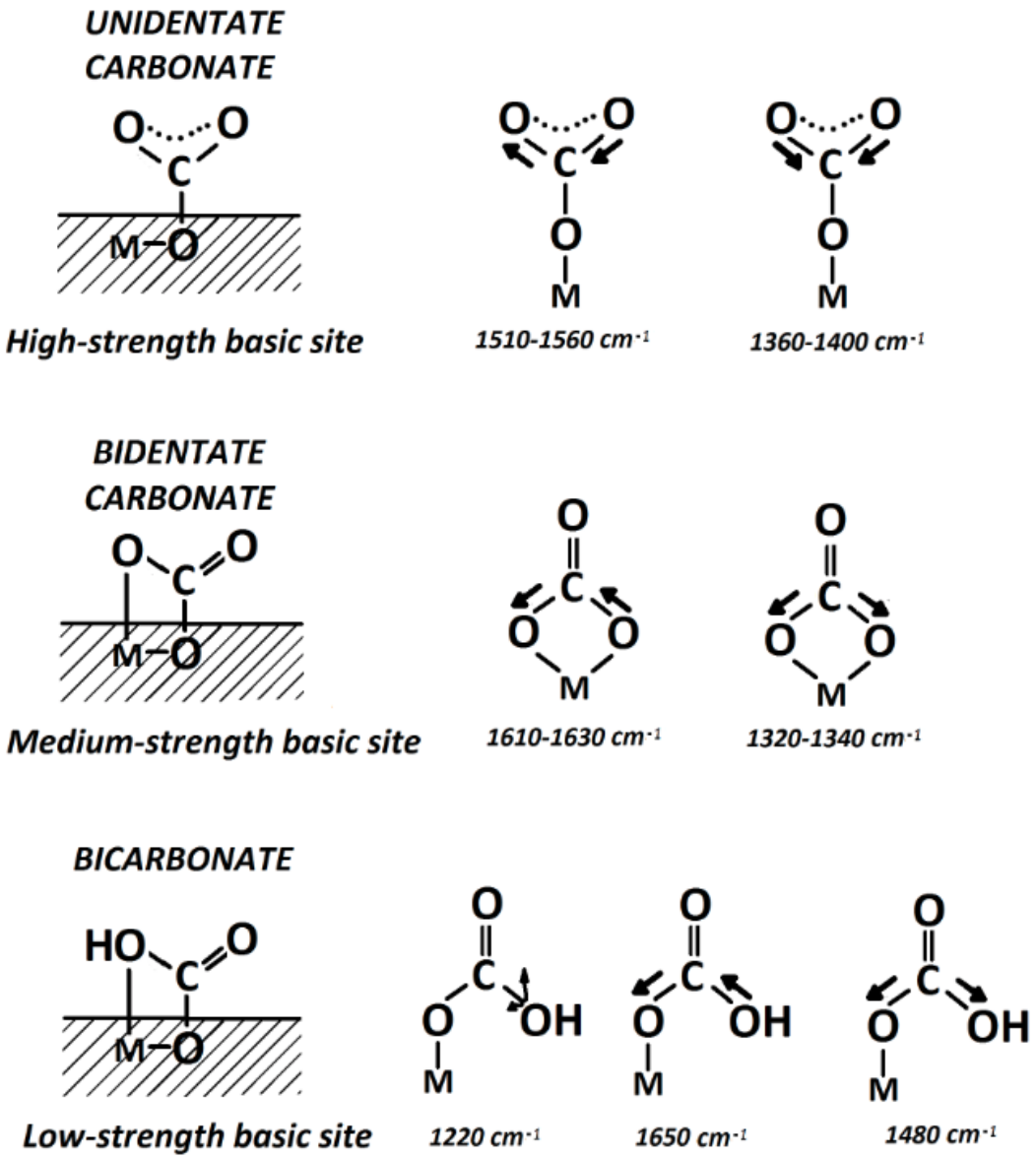


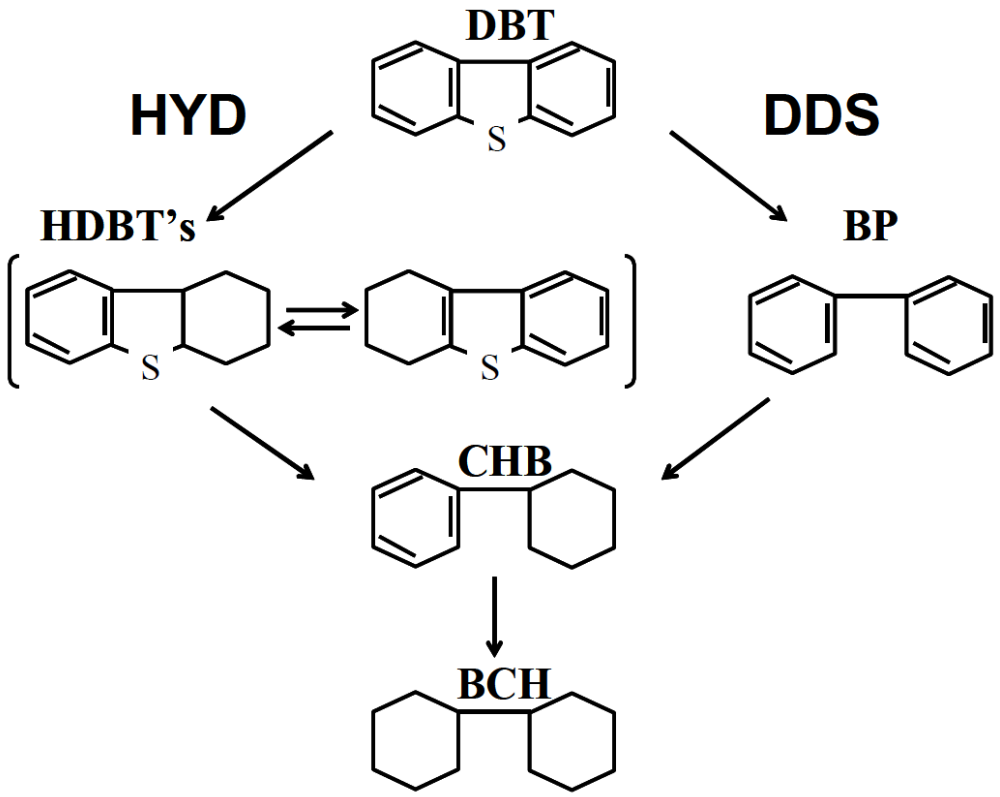
Figure S5. SEM micrographs of oxidic P-doped CoMo materials impregnated on sol-gel alumina and La-modified carriers at various rare earth contents. 4000× magnification, back-scattered electrons detector. (a): CM/A; (b): CM/ALa1; (c): CM/ALa3; (d): CM/ALa5.

Table S1. SEM-EDS chemical analysis of P-doped CoMo materials impregnated on sol-gel alumina and La-modified carriers at various rare earth contents.

CM/A	**Wt%**	**At%**
O_K	42.08	63.98
Al_K	28.92	26.07
Si_K	1.69	1.46
P_K	1.83	1.43
Co_K	3.76	1.55
Mo_K	21.73	5.51
Total	100	100
CM/ALa1		
O_K	43.35	65.02
Al_K	30.5	27.13
P_K	1.71	1.32
La_L	1.8	0.31
Co_K	3.5	1.43
Mo_K	19.14	4.79
Total	100	100
CM/ALa3		
O_K	40.79	64.82
Al_K	26.97	25.41
P_K	1.27	1.04
La_L	2.17	0.4
Co_K	4.17	1.8
Mo_K	24.64	6.53
Total	100	100
CM/ALa5		
O_K	42.26	64.55
Al_K	30.49	27.62
P_K	1.27	1.0
La_L	3.68	0.65
Co_K	3.13	1.3
Mo_K	19.18	4.89
Total	100	100



Scheme S1. Absorption bands in the infrared region of CO_2 species adsorbed on basic sites [from ref. S1].



Scheme S2. Dibenzothiophene HDS reaction network over sulfided $CoMo/Al_2O_3$ [from ref. S2]. HDBT´s: hydrodibenzothiophenes; BP: biphenyl; CHB: cyclohexylbenzene; BCH: bicyclohexyl.

References

S1 Morterra, C.; Ghiotti, G.; Boccuzzi, F.; Coluccia, S. An infrared spectroscopic investigation of the surface properties of magnesium aluminate spinel, *J. Catal*. **1978**, *51*, 299-313.

S2. Houalla, M.; Nag, N.K.; Sapre, A.V.; Broderick, D.H.; Gates, B.C. Hydrodesulfurization of dibenzothiophene catalyzed by sulfided CoO-MoO_3/γ-Al_2O_3: The reaction network. *AIChEJ* **1978**, *24*, 1015-1021.