Supplementary Material to

Comparison of four different synthetic routes of Ni_2P/TiO_2-Al_2O_3 catalysts for hydrodesulfurization of dibenzothiophene

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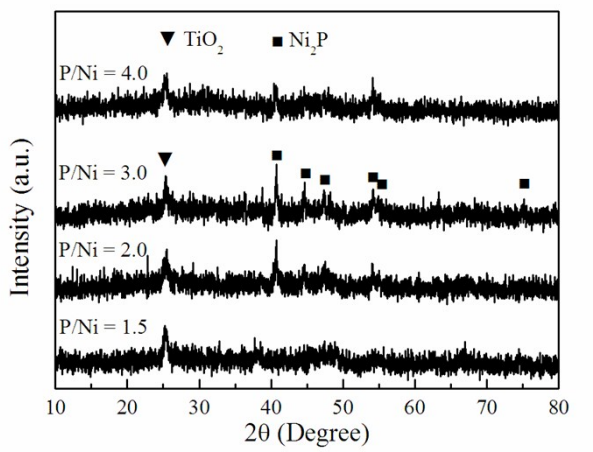

Fig. S1 XRD patterns of Ni-P/TiO_2-Al_2O_3 catalysts with different P/Ni ratios prepared by method II (Ni_2P loading = 30 wt%).

Table S1 Textural properties and superficial P/Ni mole ratios of Ni-P/TiO_2-Al_2O_3 catalysts prepared by method II (Ni_2P loading = 30 wt%)

Catalyst	S_{BET} (m^2/g)	Average pore size (nm)	Pore volume (cm^3/g)	Superficial atomic ratio P/Ni
Ni-P/Ti/Al-II-1.5	31	3.8	0.05	2.96
Ni-P/Ti/Al-II-2.0	4	4.8	0.01	-
Ni-P/Ti/Al-II-3.0	3	4.8	0.01	3.18
Ni-P/Ti/Al-II-4.0	2	4.8	0.01	-

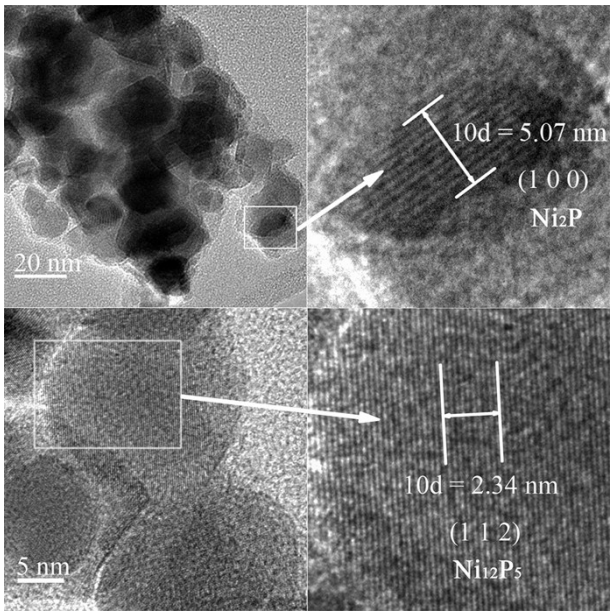

Fig. S2 High resolution TEM micrographs of the Ni-P/Ti/Al-II-1.5 catalyst.

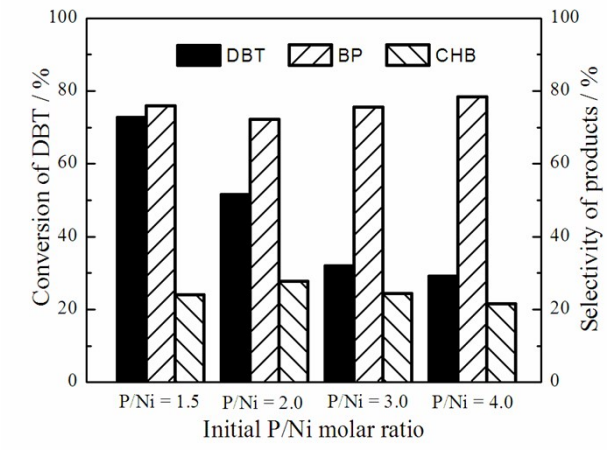

Fig. S3 HDS performance of Ni-P/TiO_2-Al_2O_3 catalysts with different P/Ni mole ratios prepared by method II (Ni_2P loading = 30 wt%). Reaction conditions: 583 K, 3.0 MPa, WHSV = 6 h^{-1}, H_2/oil = 600/1 (v/v).

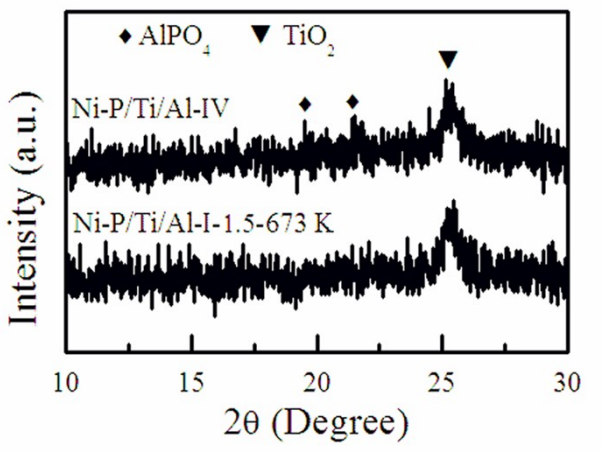

Fig. S4 Comparison of XRD patterns of the Ni-P/Ti/Al-I-1.5-673 K catalyst and Ni-P/Ti/Al-IV catalyst.

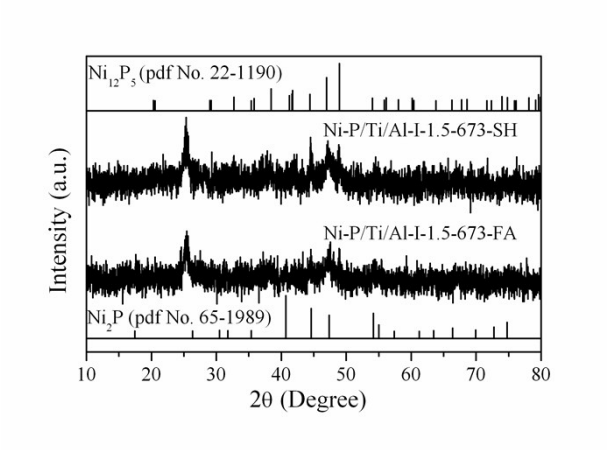

Fig. S5 XRD patterns of Ni-P/TiO_2-Al_2O_3 catalysts prepared using $NiCl_2$•$6H_2O$ and $NH_4H_2PO_2$ as precursor with an initial P/Ni mole ratio of 1.5. Ni-P/Ti/Al-I-1.5-673-SH: prepared in static H_2, Ni-P/Ti/Al-I-1.5-673-FA: prepared in flowing Ar.

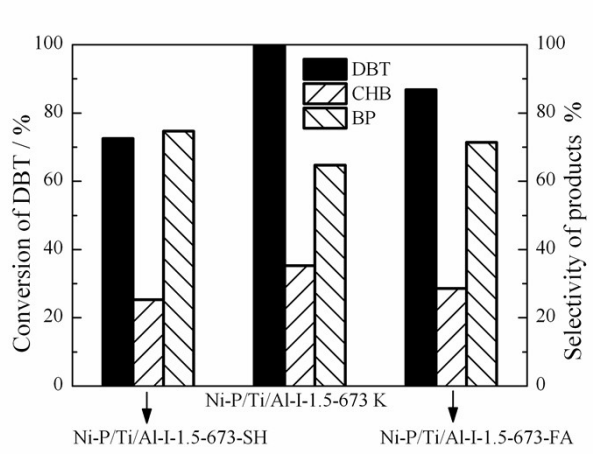

Fig. S6 Effect of preparation methods on the HDS performance of Ni-P/TiO_2-Al_2O_3 catalysts prepared using $NiCl_2$•$6H_2O$ and $NH_4H_2PO_2$ as precursor with an initial P/Ni mole ratio of 1.5. Ni-P/Ti/Al-I-1.5-673-SH: prepared in static H_2, Ni-P/Ti/Al-I-1.5-673-FA: prepared in flowing Ar. Reaction conditions: 583 K, 3.0 MPa, WHSV = 6 h^{-1}, H_2/oil = 600/1 (v/v).

Table S2 Effects of Ni-P loadings and supports on the textural properties of various supported Ni-P catalysts prepared by method II (P/Ni mole ratio = 1.5)

Catalysts	S_{BET} (m^2/g)	Average pore size(nm)	Pore volume (cm^3/g)
Ni-P/Ti/Al-II-10%	123	3.8	0.17
Ni-P/Ti/Al-II-20%	93	3.8	0.12
Ni-P/Ti/Al-II-30%	31	3.8	0.05
Ni-P/Al_2O_3-II-30%	45	3.8	0.04

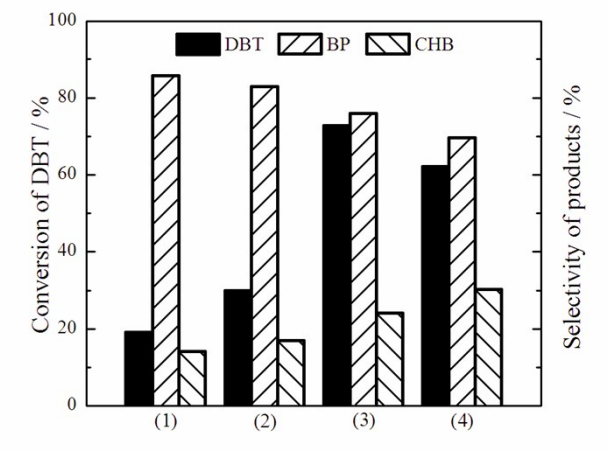

Fig. S7 HDS performance of various supported nickel phosphide catalysts prepared by method II (P/Ni = 1.5): (1) Ni-P/TiO_2-Al_2O_3, 10 wt%; (2) Ni-P/TiO_2-Al_2O_3, 20 wt%; (3) Ni-P/TiO_2-Al_2O_3, 30 wt%; (4) Ni-P/Al_2O_3, 30 wt%. Reaction conditions: 583 K, 3.0 MPa, WHSV = 6 h^{-1}, H_2/oil = 600/1 (v/v).