Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Supplementary information

Influence of intimacy for metal-mesoporous solid acids catalysts for *n*-alkanes hydro-conversion

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Supplementary information

Table SI.1 : Catalytic conditions for all described catalyst in n-heptane hydro-isomerization

Sample	Sample code	Total catalyst loading (mg)	WHSV ($g_{C7}.g_{catalyst}^{-1}.h^{-1}$)	WHSV ($g_{C7}.g_{solid\ acid}^{-1}.h^{-1}$)	H_2/n-C7 ratio	Total pressure (bar)
1	Pt/ SBA-15	50	1.15	1.15	10/1	10
2	Pt/Al-SBA-15 (20)	50	1.15	1.15	10/1	10
3	Pt/Al-SBA-15 (10)	50	1.15	1.15	10/1	10
4	Pt/Al-SBA-15 (20)	25[a]	2.3	2.3	10/1	10
5	Pt-Al-SBA-15 (20)/ γ-Al_2O_3	50	1.15	2.3	10/1	10
6	Pt-γ-Al_2O_3/Al-SBA-15 (20)	50	1.15	2.3	10/1	10
7	Pt/Siralox	50	1.15	1.15	10/1	10
8	Pt/Siralox	25 [a]	2.3	2.3	10/1	10
9	Pt-γ-Al_2O_3/Siralox	50	1.15	2.3	10/1	10
10	Pt-Siralox/γ-Al_2O_3	50	1.15	2.3	10/1	10

[a] Adjusted loading in the reactor to get similar total number of acid sites for comparison with the composites samples

Table SI.2 : Catalytic conditions for all described catalyst in n-hexadecane hydro-cracking

Sample	Sample code	Total catalyst loading (mg)	WHSV ($g_{C16}.g_{catalyst}^{-1}.h^{-1}$)	WHSV ($g_{C16}.g_{solid\ acid}^{-1}.h^{-1}$)	H_2/n-C16 ratio	Total pressure (bar)
1	Pt/Al-SBA-15 (20)	50	1.7	1.7	10/1	5
2	Pt/Al-SBA-15 (10)	50	1.7	1.7	10/1	5
3	Pt/Al-SBA-15 (20)	25[a]	3.4	3.4	10/1	5
4	Pt-γ-Al_2O_3/Al-SBA-15 (20)	50	1.7	3.4	10/1	5
5	Pt-Al-SBA-15 (20)/ γ-Al_2O_3	50	1.7	3.4	10/1	5
6	Pt/Siralox	50	1.7	1.7	10/1	5

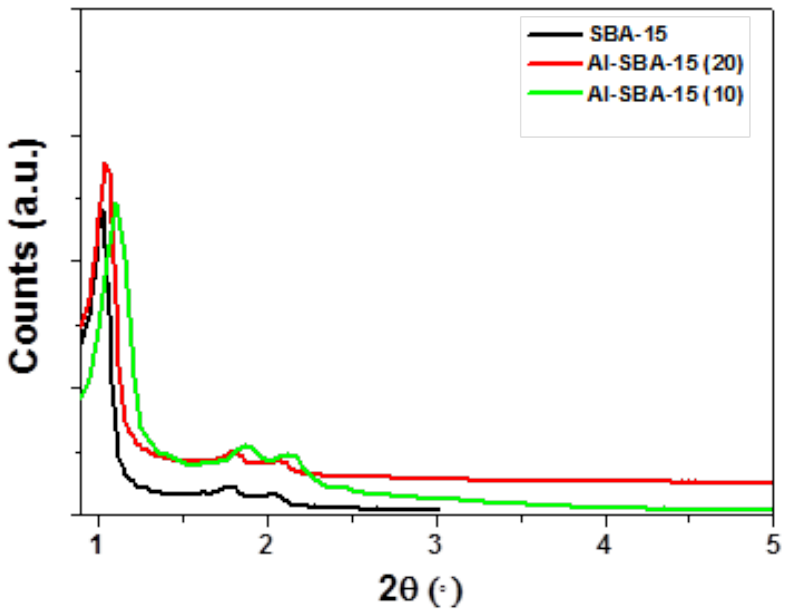

Fig. SI.1 Small angle XRD measurements of SBA-15; black line, Al-SBA-15(20), red line; Al-SBA-15(10), green line.

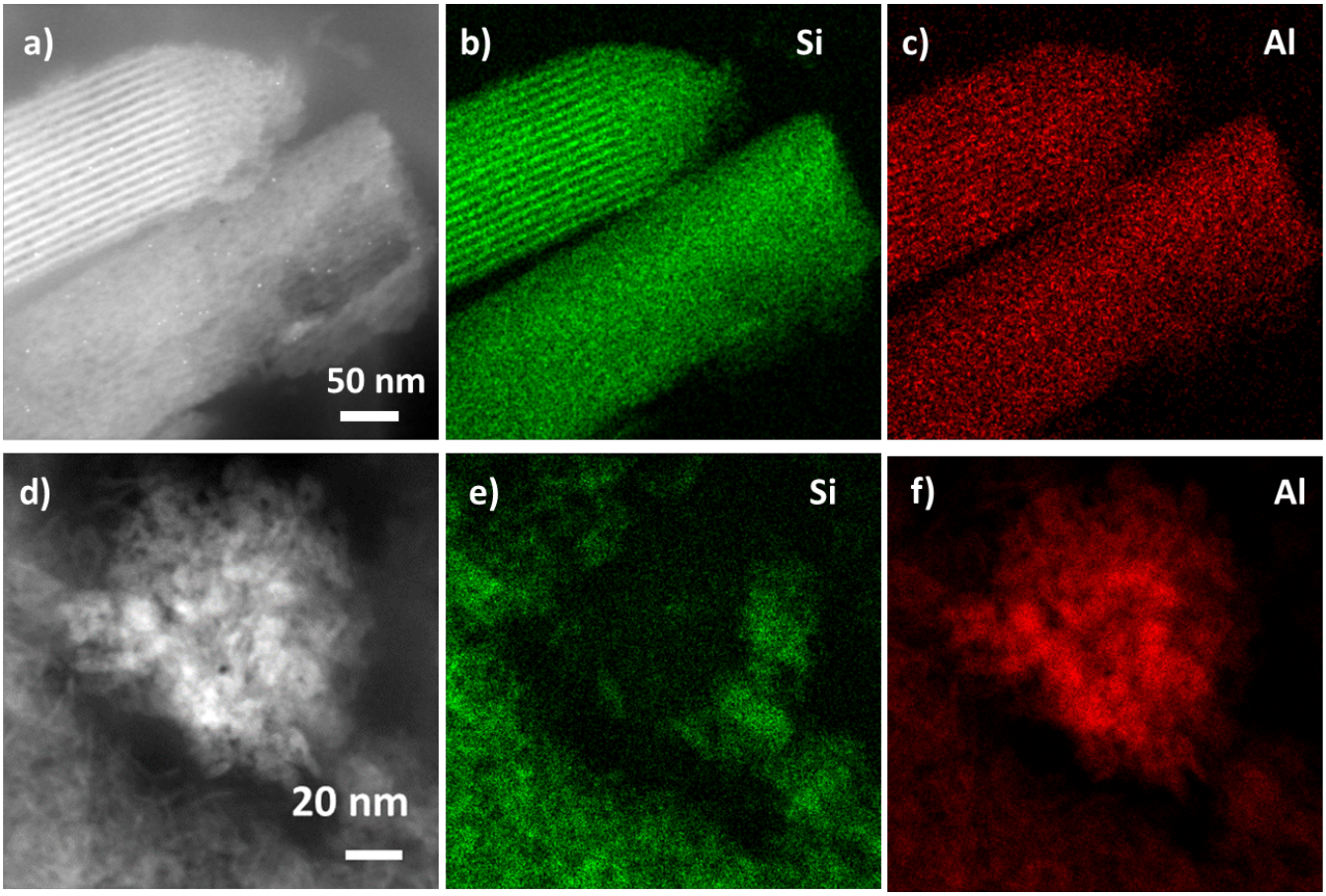

Fig SI.2 a. HAADF-STEM image of Al-SBA-15(20). b. and c. EDX mapping of Si and Al. Al elemental mapping suggest a uniform Al dispersion along the walls of SBA-15

d. HAADF-STEM image of Siralox40hpv. e. and f. EDX mapping of Si and Al. Al elemental mapping suggest a non-uniform Al dispersion with presence of Al domains

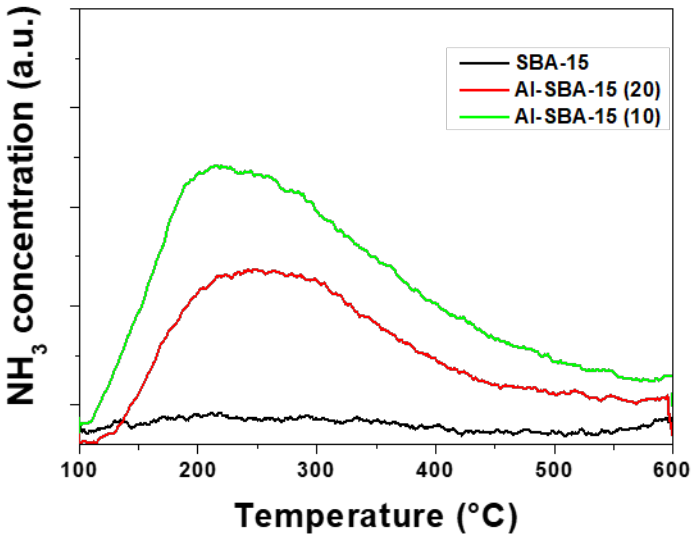

Fig. SI.3 NH3-TPD measurements of SBA-15; black line, Al-SBA-15(20), red line; Al-SBA-15(10), green line;

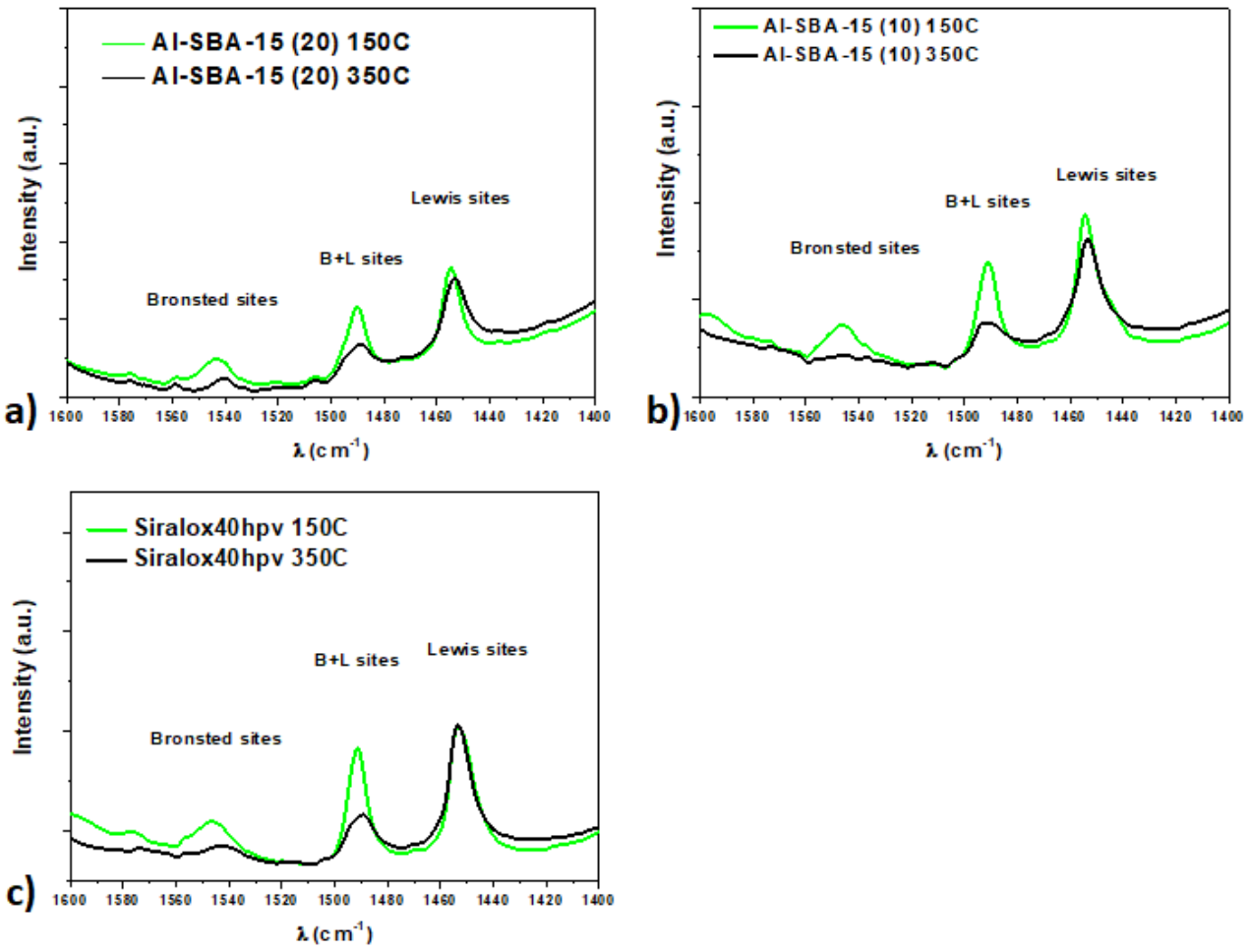

Fig SI.4 Pyridine desorption - Infrared spectrum of a) Al-SBA-15(20) b) Al-SBA-15(10) c) Siralox40hpv (Desorption at 150°C (green line); and 350°C (black line) at 1.10^{-5} bar)

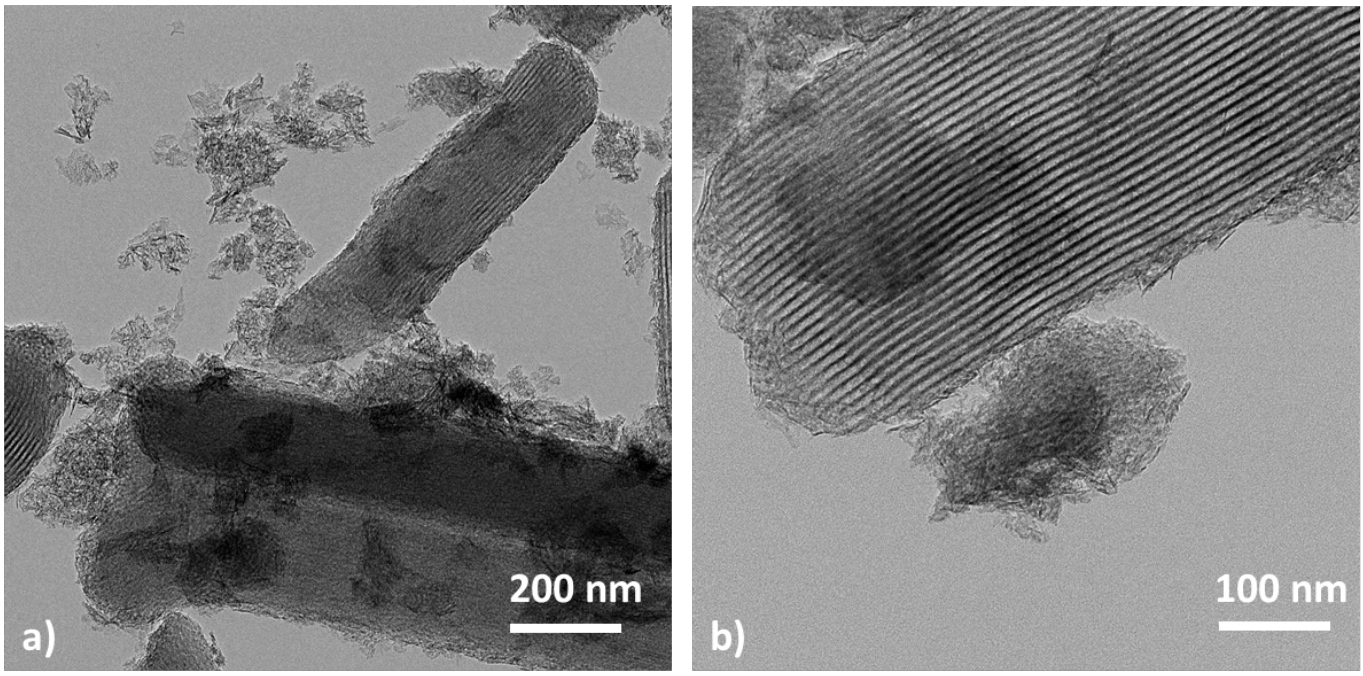

Fig SI.5 TEM images of the γ-Al_2O_3/Al-SBA-15 composite. The coverage of Al-SBA-15 by the alumina is apparent from Fig. SI.5-b.

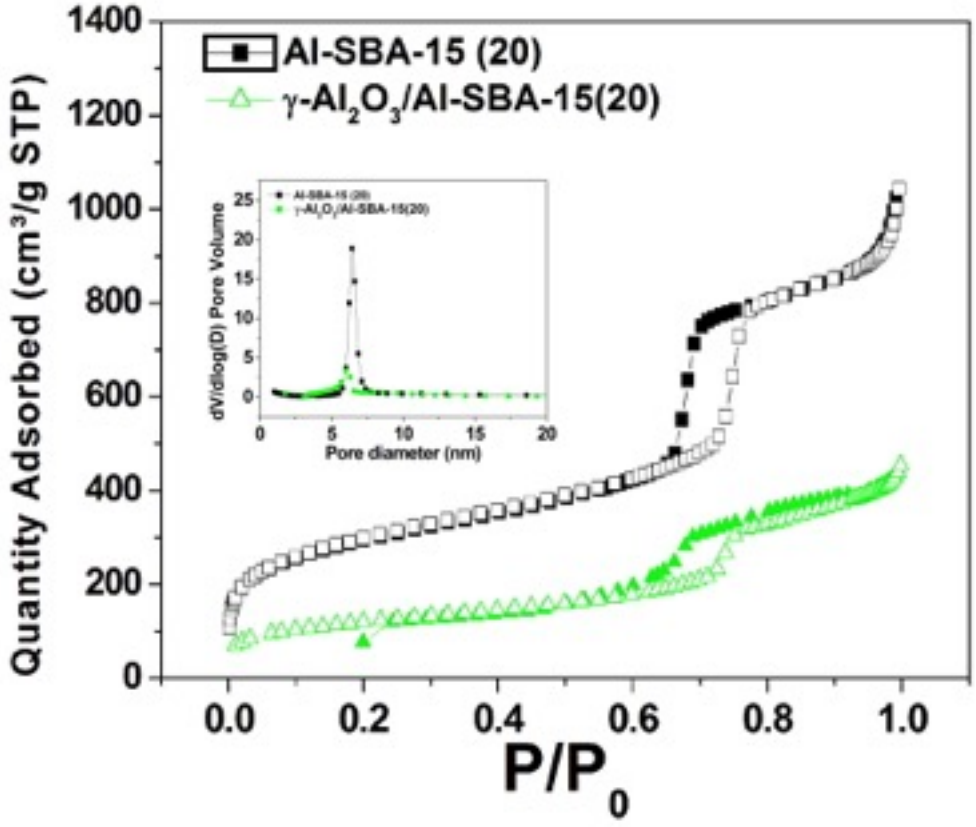

Fig. SI.6 N_2 physisorption analysis of Al-SBA-15(20), black line which and composite Al-SBA-15(20)/ γ-Al_2O_3 green line. Both contain mesopores with an average pore size around 6 nm.

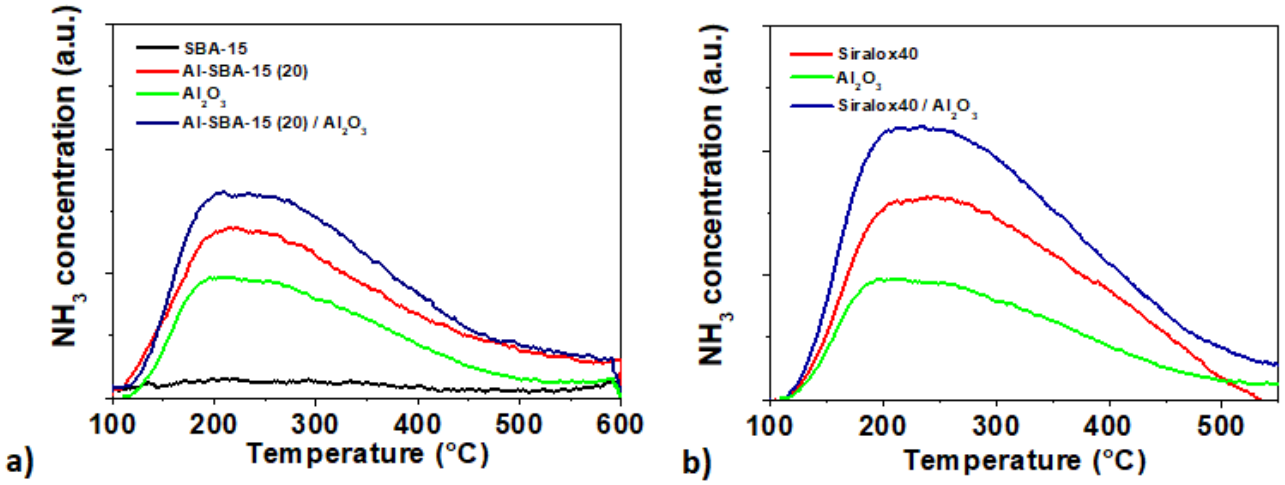

Fig. SI.7 NH3-TPD measurements of a) SBA-15; black line, Al-SBA-15(20), red line; γ-Al_2O_3, green line; composite Al-SBA-15(20)/ γ-Al_2O_3, blue line b) Siralox40, red line; γ-Al_2O_3, green line; composite Siralox40/γ-Al_2O_3, blue line

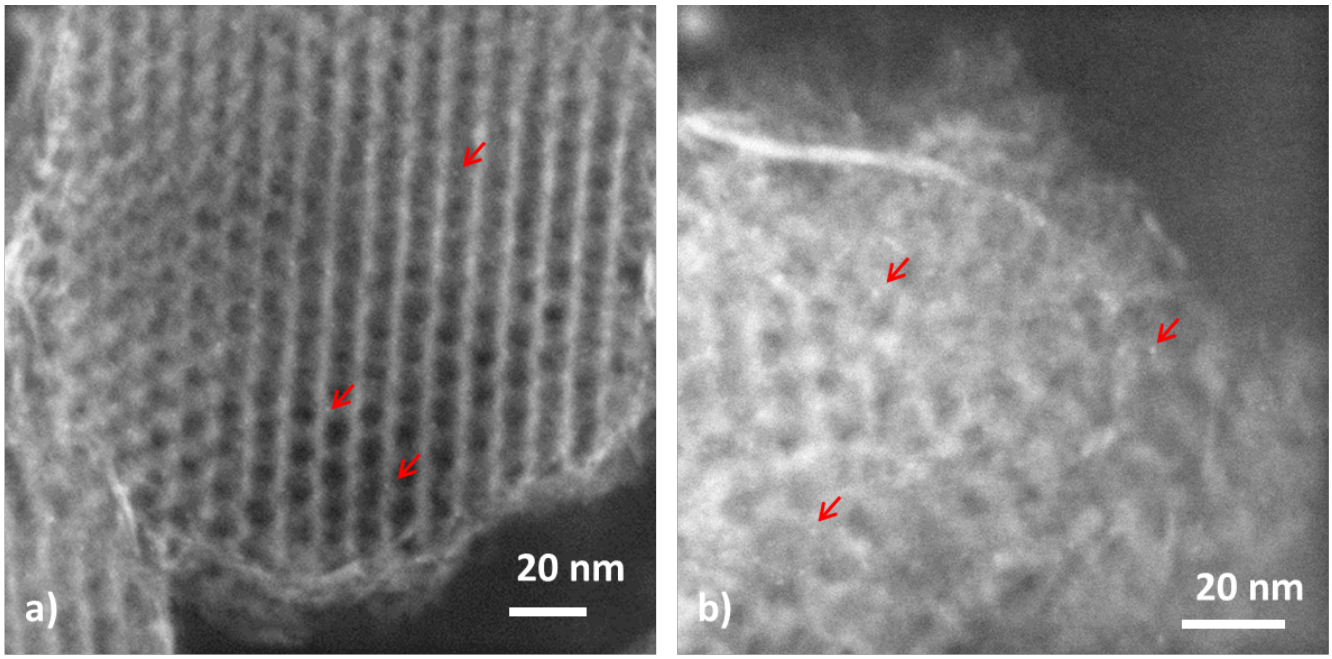

Fig SI.8. TEM images of the Pt-Al-SBA-15/γ-Al_2O_3 catalyst. Pt particles are observed on the Al-SBA-15 (a) but also on the binder (b), pointing to an non-selective Pt deposition.

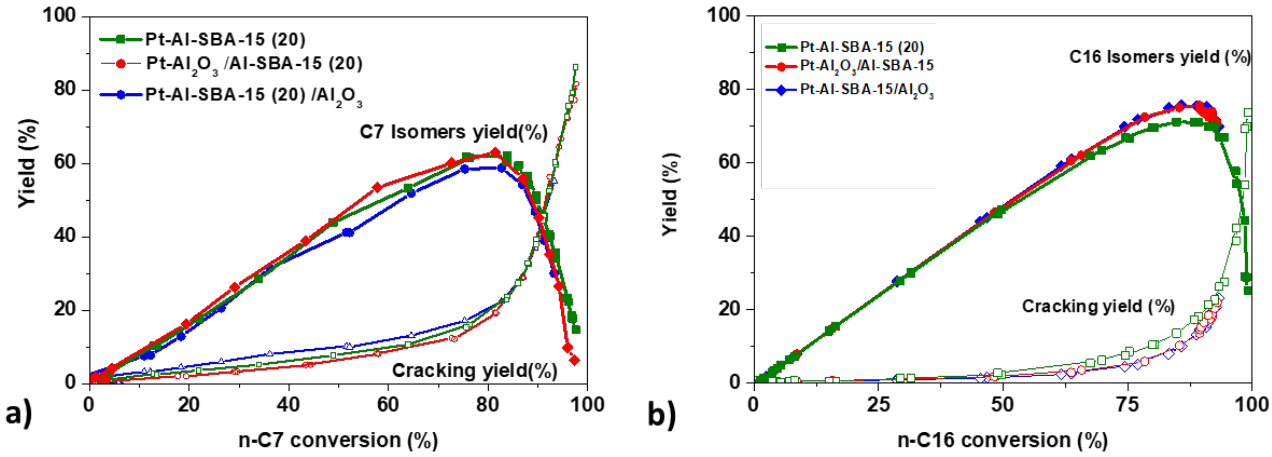

Fig SI.9.a. Yields of C7 isomers and cracking products for *n*-heptane conversion for Pt-Al-SBA-15(20) ($[Pt(NH_3)_4](NO_3)_2$]) (green squares); Pt-γ-Al_2O_3/Al-SBA-15(20) ($H_2PtCl_6 \cdot 6H_2O$) (red diamonds) and Pt- Al-SBA-15(20) /γ-Al_2O_3 ($[Pt(NH_3)_4](NO_3)_2$]) (blue circles) . Catalysis performed at 10 bar ; H_2/n-C_7= 10/1 mol/mol; WHSV = 1.15-2.3 $g_{n\text{-}C7}.g_{solid\ acid}.h^{-1}$ b. Yield of C16 isomers and cracking products. Catalysis performed at 5 bar ; H_2/n-C_{16}= 10/1; WHSV = 1.7-3.4 $g_{n\text{-}C16}.g_{solid\ acid}.h^{-1}$

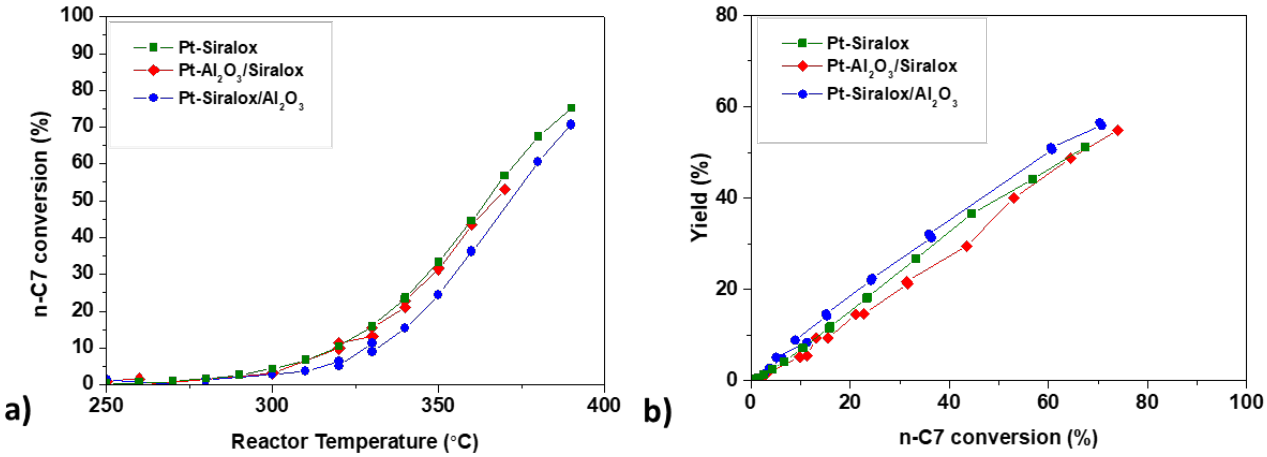

Fig SI.10.a. Conversion profile of n-heptane against temperature for Pt-Siralox40hpv ($[Pt(NH_3)_4](NO_3)_2$]) (green squares); Pt-γ-Al_2O_3/Siralox40hpv ($H_2PtCl_6 \cdot 6H_2O$) (red diamonds) and Pt-Siralox40hpv/γ-Al_2O_3 ($[Pt(NH_3)_4](NO_3)_2$]) (blue circles) b. Yields of C7 isomers

Catalysis performed at 10 bar ; H_2/n-C_7= 10/1 mol/mol; WHSV = 1.15-2.3 $g_{n\text{-}C7}.g_{solid\ acid}.h^{-1}$

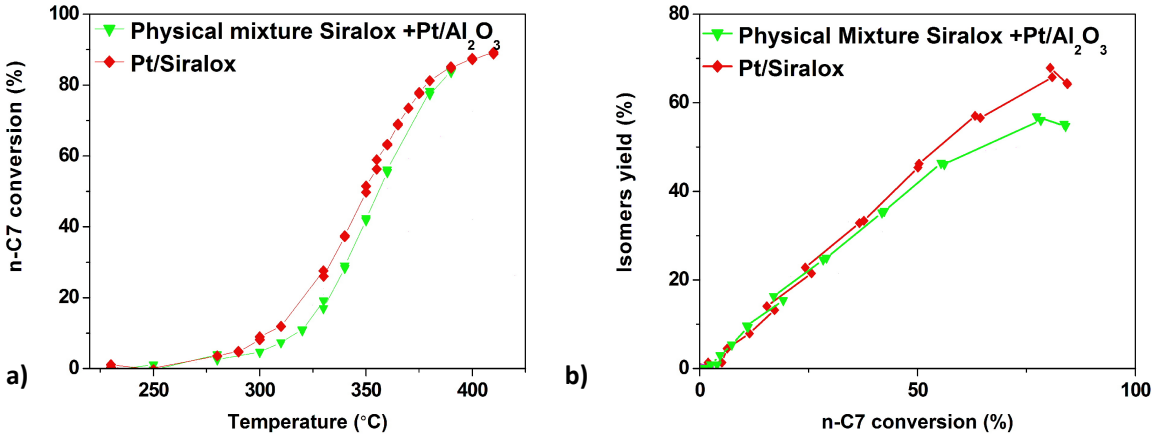

Fig SI.11.a. Conversion profile of n-heptane against temperature for Pt-Siralox40hpv ($[Pt(NH_3)_4](NO_3)_2$]) (red diamonds); Pt-γ-Al_2O_3 + Siralox40hpv (green squares), physical mixture of 75-212 µm grains b. Yields of C7 isomers Catalysis performed at 10 bar ; H_2/n-C_7= 10/1 mol/mol; WHSV = 1.15 $g_{n\text{-}C7}.g_{solid\ acid}.h^{-1}$

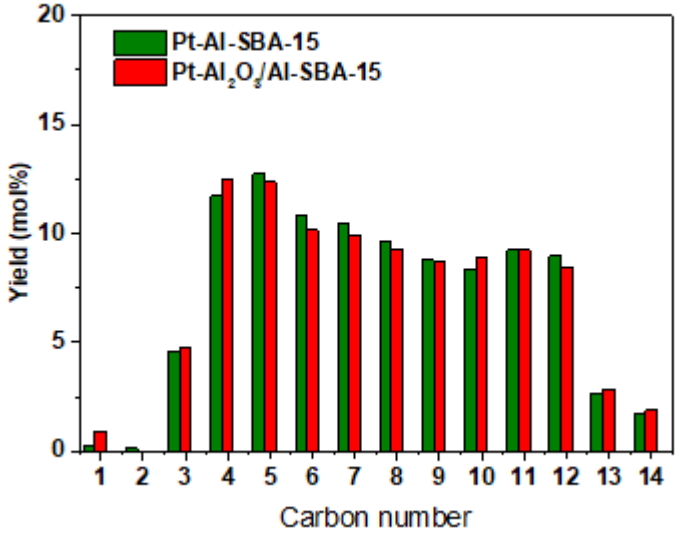

Fig SI.12. Cracking products distribution (mol%) per function of their carbon number for Pt-Al-SBA-15 and Pt-Al_2O_3/Al-SBA-15 at *n*-C16 conversion = 80%, T = 290 ˚C.

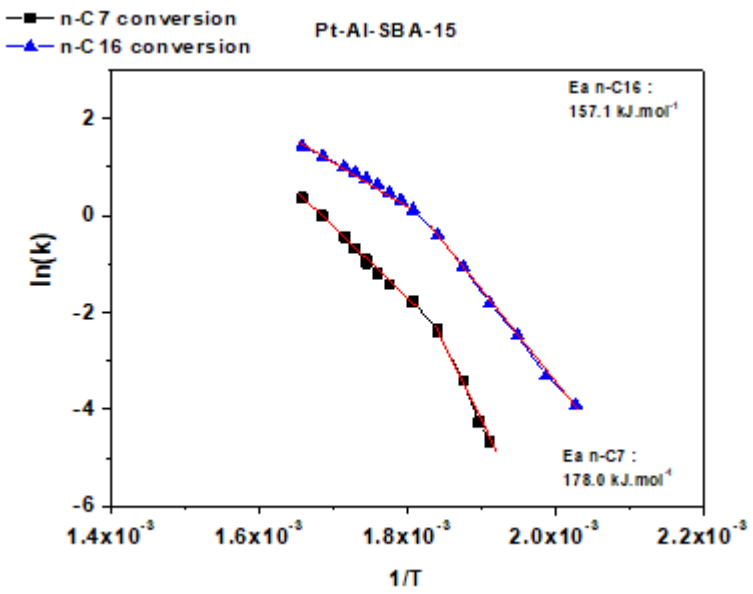

Fig SI.13. Arrhenius plots for *n*-C7 and *n*-C16 conversion for Pt-Al-SBA-15(20).
k is determined assuming first order reaction with ln(k) = ln(-ln(1-X)) with X being *n*-C7 conversion or *n*-C16 conversion, T in K.

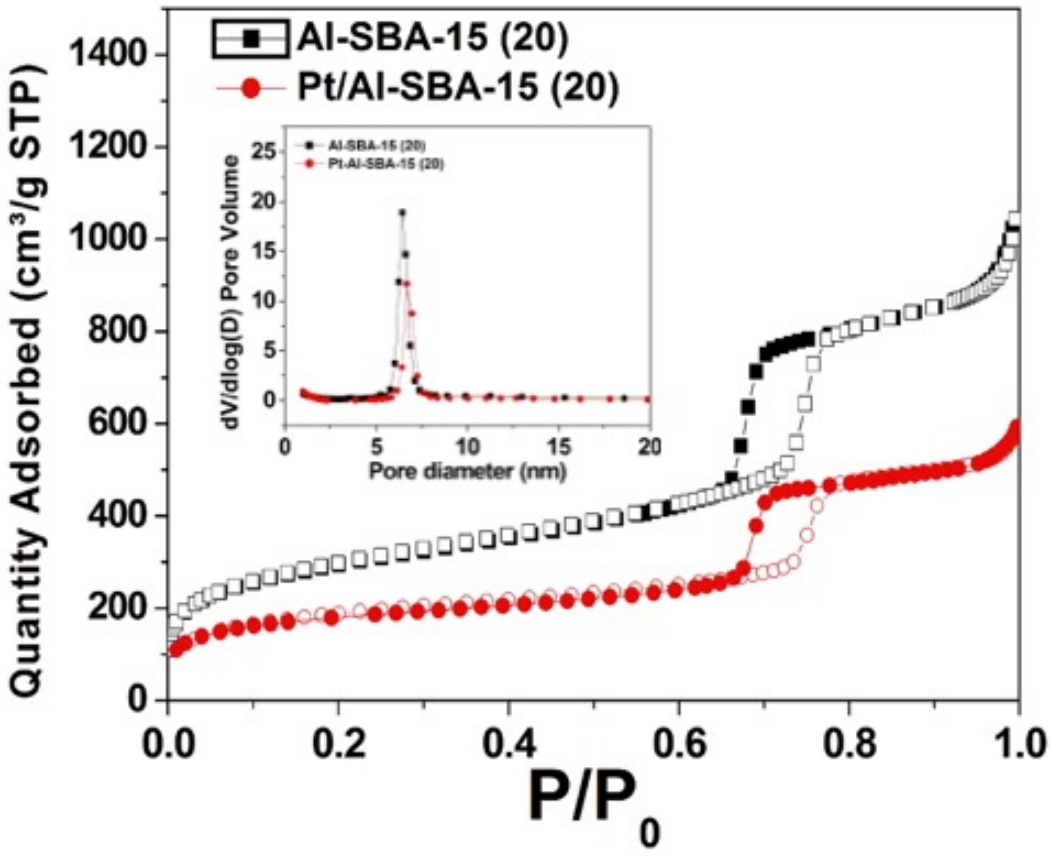

Fig. SI.14 N_2 physisorption analysis of Al-SBA-15(20), black line, and Pt-Al-SBA-15(20) red line. Both contain mesopores with an average pore size around 6 nm.