

Article

Supporting Information: Vapor-phase furfural decarbonylation over a high-performance catalyst of 1%Pt/SBA-15

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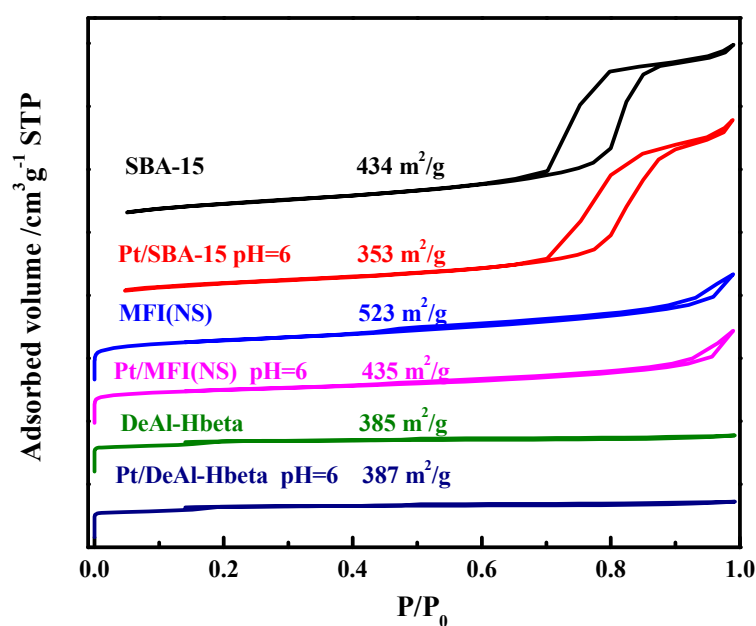


Figure S1. N₂ sorption isotherms of Pt catalysts on different supports.

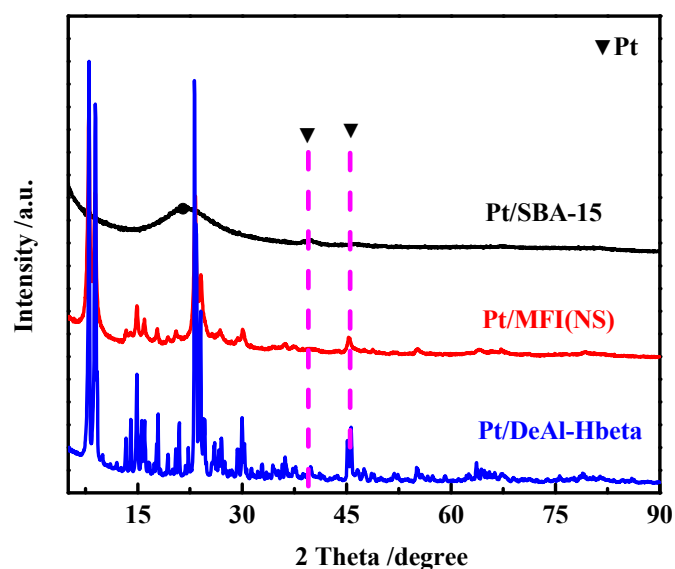


Figure S2. XRD patterns of 1%Pt/SBA-15, 1%Pt/MFI(NS) and 1%Pt/DeAl-Hbeta catalysts.

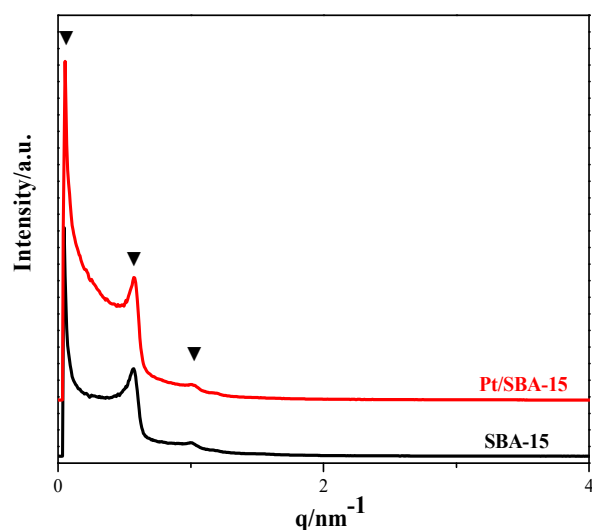


Figure S3. Small-angle X-ray scattering patterns of SBA-15 and Pt/SBA-15.

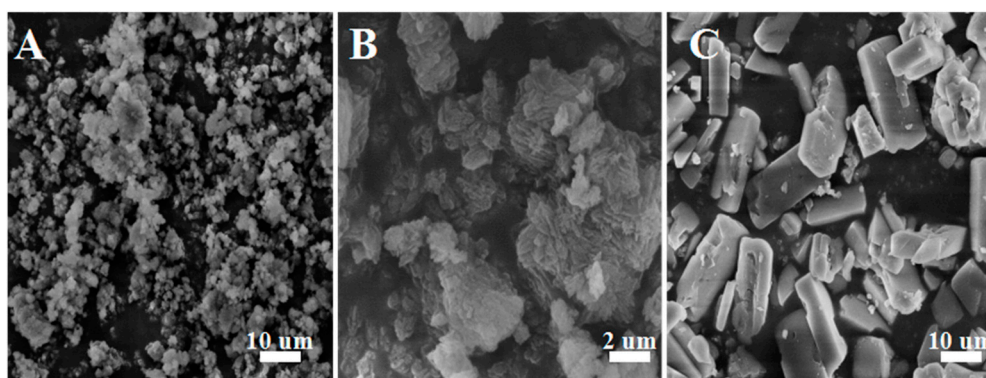


Figure S4. SEM images of (A) 1%Pt/SBA-15, (B) 1%Pt/MFI(NS), (C) 1%Pt/DeAl-Hbeta.

Table S1. Specific surface areas and pore structures of the silica supports and Pt catalysts.

Catalyst	S_{BET} (m^2/g)	S_{Ext} (m^2/g)	S_{micro} (m^2/g)	V_{BJH} (cc/g)	V_{meso} (cc/g)	V_{micro} (cc/g)	D_{BJH} (nm)
SBA-15	434	389	45	1.2	1.2	0.0	7.8
MFI(NS)	523	223	300	0.5	0.4	0.1	3.7
DeAl-Hbeta	385	246	139	0.1	0.0	0.1	0.6*
1%Pt/SBA-15 pH=1	390	341	49	1.2	1.2	0.0	7.8
1%Pt/SBA-15 pH=2	382	332	50	1.2	1.2	0.0	7.8
1%Pt/SBA-15 pH=6A	354	303	51	1.2	1.2	0.0	7.8
1%Pt/SBA-15 pH=6B	350	308	41	1.2	1.2	0.0	7.8
1%Pt/SBA-15 pH=6C	366	317	49	1.2	1.2	0.0	7.8
1%Pt/MFI(NS)	435	208	227	0.4	0.3	0.1	3.6
1%Pt/DeAl-Hbeta	387	251	136	0.1	0.0	0.1	0.6*

*Determined by N_2 adsorption and desorption experiments and the H-K formula.

Table S2. Metallic Pt dispersion and nano particle size of Pt determined by CO pulse adsorption.

Catalyst	Dispersion (%)	Particle size (nm)
1%Pt/SBA-15 pH=1	27.8	4.1
1%Pt/SBA-15 pH=2	26.7	4.2
1%Pt/SBA-15 pH=6A	12.8	8.9

1%Pt/SBA-15 pH=6B	13.1	8.7
1%Pt/SBA-15 pH=6C	16.3	7.0
1%Pt/MFI(NS)	6.1	18.4
1%Pt/DeAl-Hbeta	19.9	5.7

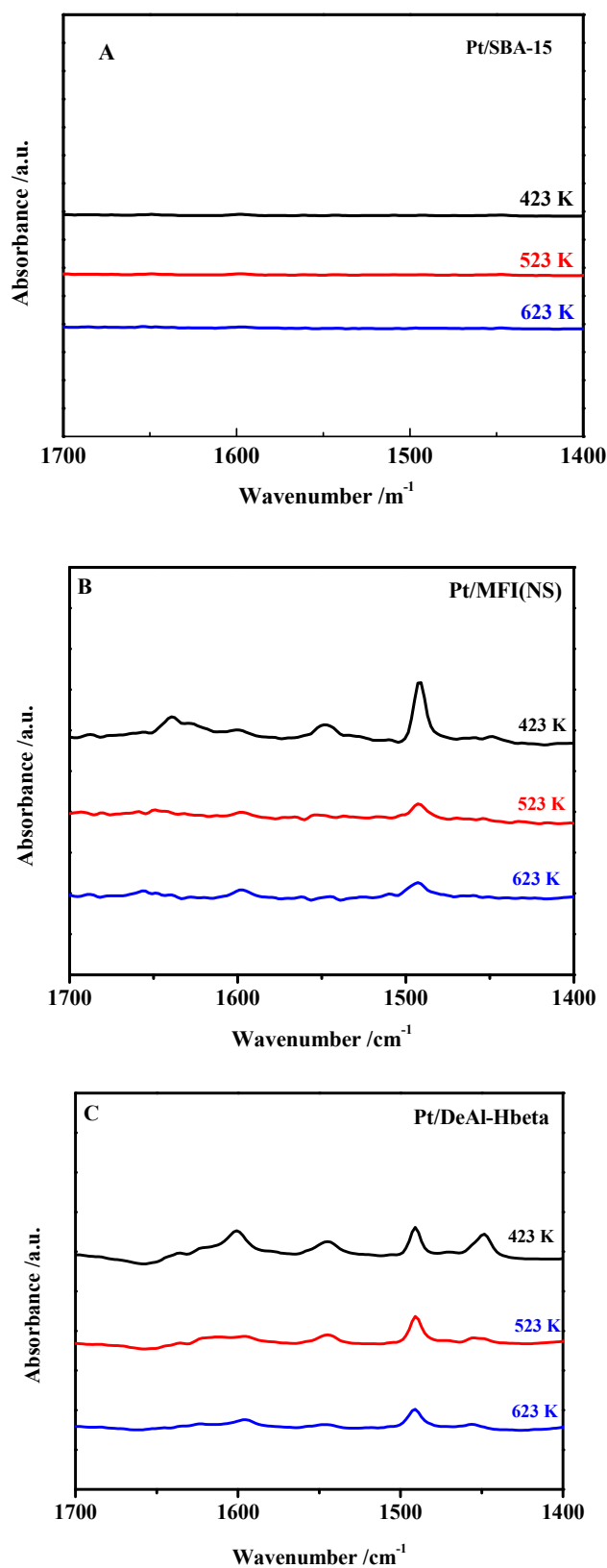


Figure S5. Pyridine-IR spectra of (A) 1%Pt/SBA-15, (B) 1%Pt/MFI(NS) and (C) 1%Pt/DeAl-Hbeta catalysts desorbed at 423 K, 523 K and 623 K.

Table S3. Numbers of acid sites on different silica supported Pt catalysts.^a

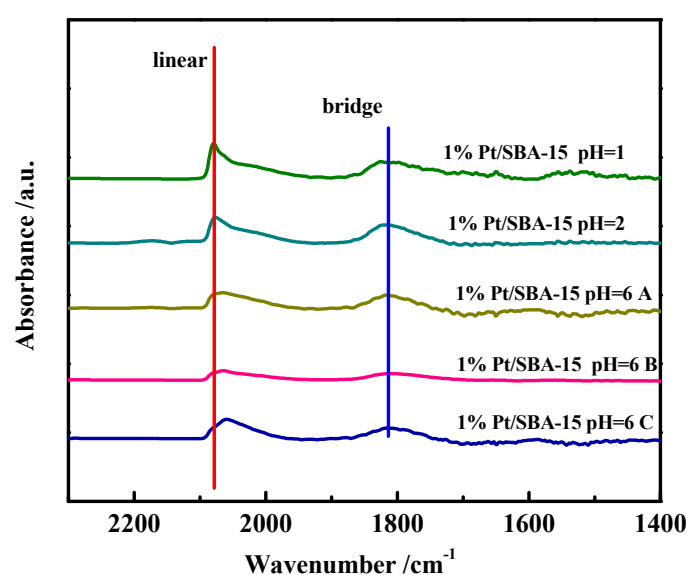
Catalyst	L ^a acid amount / $\mu\text{mol}\cdot\text{g}^{-1}$	B ^a acid amount / $\mu\text{mol}\cdot\text{g}^{-1}$
1%Pt/SBA-15	0	0
1%Pt/MFI(NS)	0	9.1
1%Pt/DeAl-Hbeta	5.8	4.9

^a The numbers L and B acid sites were calculated based on the areas of peaks at 1450 and 1540 cm^{-1} , respectively, in the pyridine-FTIR spectra (423 K).

Table S4. Catalytic performance of the various catalysts.

Catalyst	Conversion /%	Furan selectivity /%	2-MF selectivity /%	THF selectivity /%	2-MTHF selectivity /%	Propylene selectivity /%	C-Balance /%
1%Pt/SBA-15 pH=6A ^[a]	100.0	74.4	2.1	2.2	2.0	-	80.6
1%Pt/MFI(NS) ^[a]	97.6	77.3	1.6	2.8	1.4	-	83.1
1%Pt/DeAl-Hbeta ^[a]	75.6	50.6	0.6	0.8	3.4	-	55.4
1%Pt/SBA-15 pH=1	81.9	70.9	0.1	2.9	0.4	-	74.4
1%Pt/SBA-15 pH=2	91.5	77.6	0.3	1.1	2.3	-	81.2
1%Pt/SBA-15 pH=6A	95.3	73.7	0.0	0.4	2.6	-	76.6
1%Pt/SBA-15 pH=6B	89.9	70.6	0.0	0.3	2.6	-	73.6
1%Pt/SBA-15 pH=6C	87.4	87.2	0.0	0.2	3.9	2.3	93.5

Denoted: Furfural conversion and products selectivity were the average values from 2 h to 6 h TOS. The dash in the column of propylene selectivity means not detected. Reaction conditions: [a] 573 K, WHSV=3.3 h^{-1} , $\text{H}_2/\text{furfural}$ (mol) = 2.4; other experiments were conducted at 573 K, WHSV=16.5 h^{-1} , $\text{H}_2/\text{furfural}$ (mol) = 2.4.

**Figure S6.** CO-FTIR spectra of 1%Pt/SBA-15 catalysts prepared at different conditions.

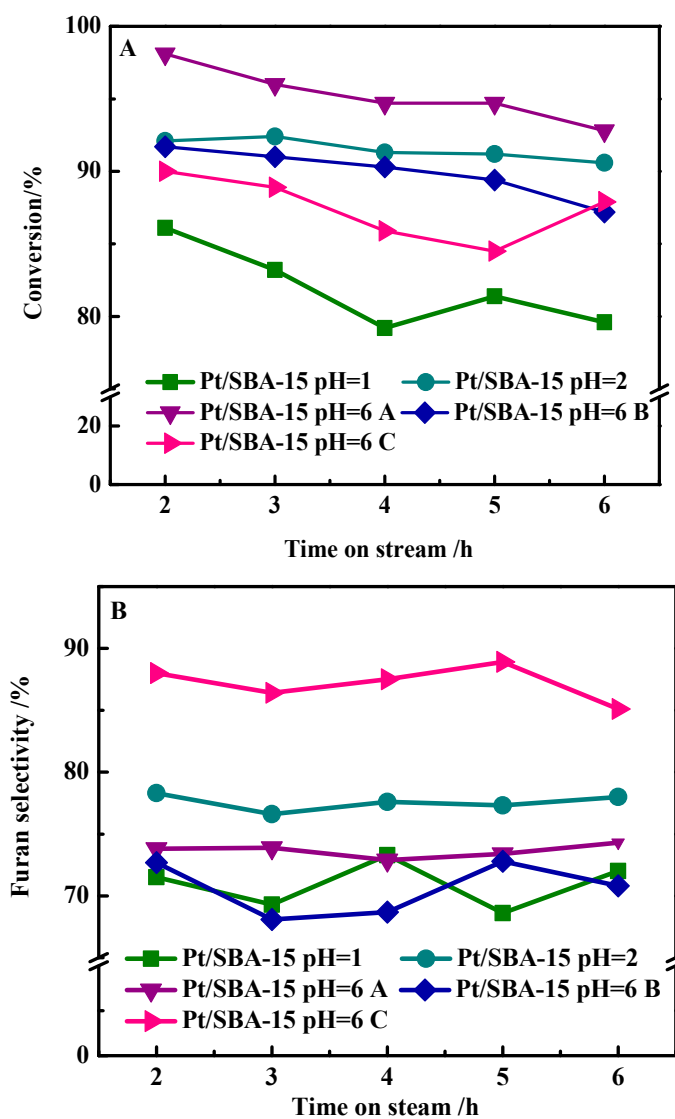


Figure S7. (A) Furfural conversion and (B) furan selectivity as a function of time on stream.



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