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

SUPPLEMENTARY INFORMATION

Platinum nanoparticles on 3D graphene-like zeolite-templated carbon for benzene hydrogenation

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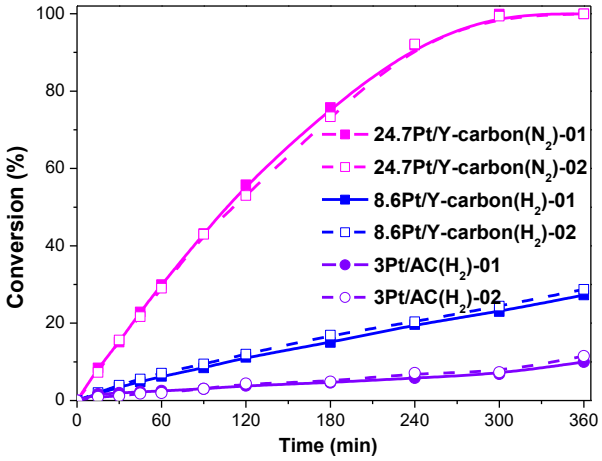

Figure S1. The reproducibility of catalytic measurements of hydrogenation of benzene to cyclohexane.

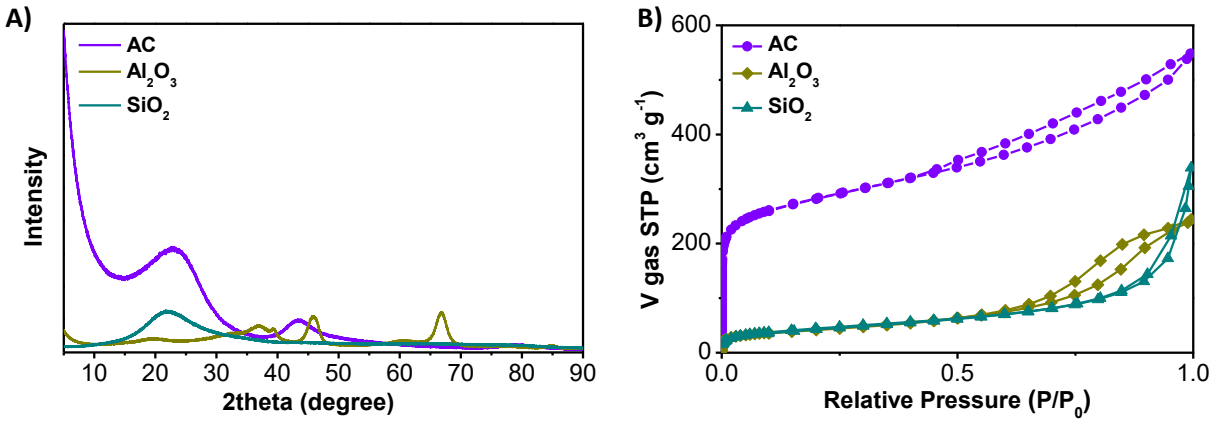

Figure S2. Characterization of catalyst supports used for the preparation of comparative Pt/catalysts. A) XRD analysis and B) N_2 adsorption at 77 K.

Table S1. Textural properties of alumina, silica and activated carbon supports used for the preparation of comparative Pt/catalysts obtained from N_2 adsorption/desorption at 77 K.

	V_{micro} $cm^3\ g^{-1}$	V_{meso} $cm^3\ g^{-1}$	V_{tot} $cm^3\ g^{-1}$	S_{tot} $m^2\ g^{-1}$
AC	0.44	0.43	0.87	1031
Al_2O_3	0.04	0.30	0.34	153
SiO_2	0.04	0.11	0.15	161

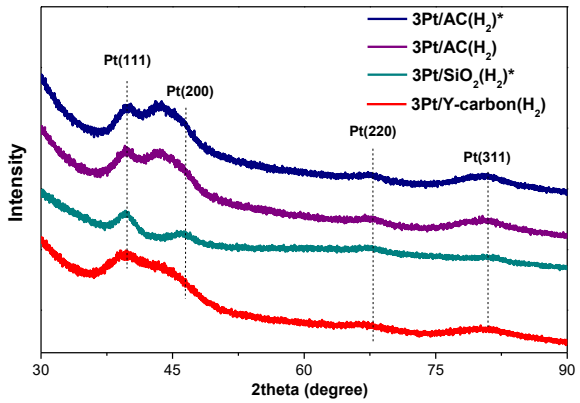

Figure S3. XRD analysis of 3Pt/catalysts with characteristic lines of metal platinum.

Table S2. Repeated use of Pt/*Y*-carbon catalysts in the hydrogenation of benzene carried out in a pressure batch reactor at a temperature of 100 °C and a pressure of 10 bar with *n*-heptane as a solvent. The catalysts were reused without any treatment or activation between catalytic runs.

Catalyst	**Catalyst productivity at 180 min mol g_{cat}^{-1} s^{-1}**		
	1st Run, fresh catalysts	**2nd Run, used catalyst**	**3rd Run, used catalyst**
8.6Pt/*Y*-carbon(H_2)	$1.87 \cdot 10^{-4}$	$1.92 \cdot 10^{-4}$	$1.01 \cdot 10^{-4}$
24.7Pt/*Y*-carbon(N_2)	$1.42 \cdot 10^{-3}$	$1.36 \cdot 10^{-3}$	$1.11 \cdot 10^{-3}$

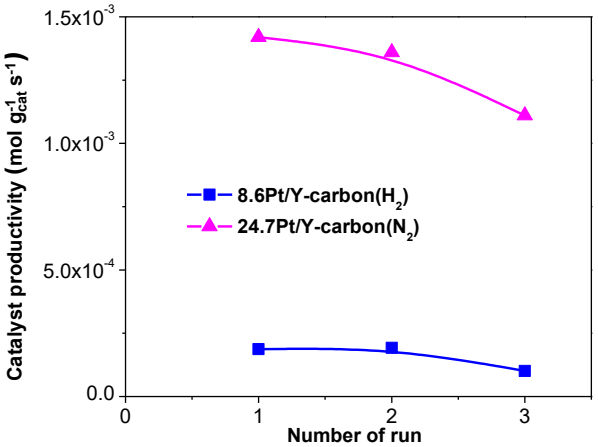

Figure S4. Catalyst productivity in the hydrogenation of benzene at a temperature of 100 °C and a pressure of 10 bar with *n*-heptane as a solvent for fresh and repeatedly used catalyst.

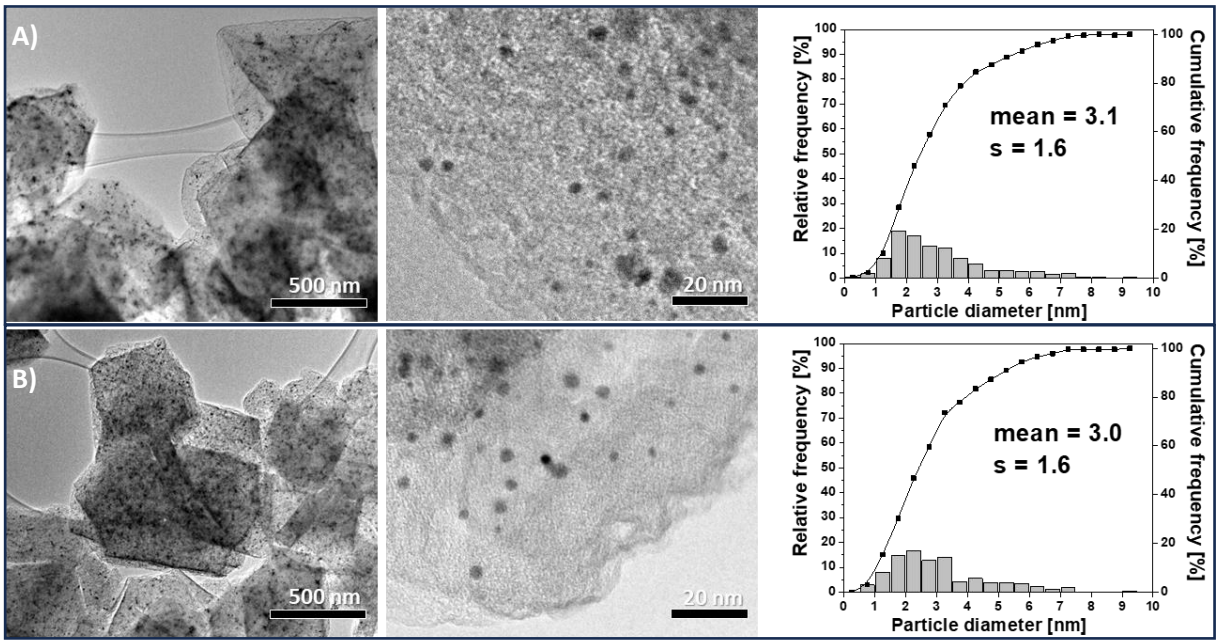

Figure S5. HR-TEM analysis of 8.6Pt/*Y*-carbon(H_2) A) before and B) after three subsequent catalytic tests in the hydrogenation of benzene.

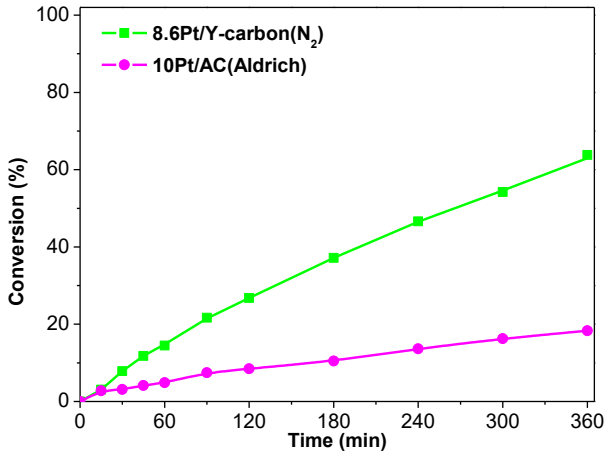

Figure S6. Comparison of benzene to cyclohexane conversions in the benzene hydrogenation for 8.6Pt/*Y*-carbon(N_2) and a commercial 10Pt/AC catalyst (Aldrich, PN 205958, Lot. MKCM3796) with 10 wt.% Pt deposited on activated carbon.

Table S3. Comparison of the productivity of Pt/*Y*-carbon(N_2) catalysts with reported Pt-catalysts for benzene hydrogenation.

Catalyst	Catalyst productivity mol g_{cat}^{-1} s^{-1}	Conditions of the catalytic test	Ref.
24.7Pt/*Y*-carbon(N_2)	$10.6 \cdot 10^{-4}$	batch/(l); 100 °C; 10 bar	This study
8.6Pt/*Y*-carbon(N_2)	$4.8 \cdot 10^{-4}$	batch/(l); 100 °C; 10 bar	This study
3Pt/*Y*-carbon(N_2)	$1.4 \cdot 10^{-4}$	batch/(l); 100 °C; 10 bar	This study
10Pt/AC(Aldrich)	$1.6 \cdot 10^{-4}$	batch/(l); 100 °C; 10 bar	This study
10Pt/Al_2O_3	$3.72 \cdot 10^{-5}$	flow/(g); 80 °C; H_2/B=5; 1 ml/s	[1]
0.34Pt/Al_2O_3	$1.24 \cdot 10^{-5}$	flow/(g); 80 °C H_2/B=692/68 Torr	[2]
1.91Pt/SiO_2	$2.15 \cdot 10^{-5}$	flow/(g); 80 °C H_2/B=692/68 Torr	[2]
0.5Pt/MOR	$6.11 \cdot 10^{-7}$	flow/(g); 80 °C; H_2/B=9; 1 bar; WHSV=8.8 h^{-1}	[3]
0.5Pt/USY	$6.67 \cdot 10^{-6}$	flow/(g); 80 °C; H_2/B=9; 1 bar; WHSV=8.8 h^{-1}	[3]
11Pt/SWCNT	$6.33 \cdot 10^{-5}$	batch/(l); 20 °C; 22.5 mmol of benzene; 10 bar	[4]
10Pt/AC	$1.38 \cdot 10^{-5}$	batch/(l); 20 °C; 22.5 mmol of benzene; 10 bar	[4]
0.96Pt/SiO_2	$3.80 \cdot 10^{-6}$	flow/(g); 60°C; H_2/B=1.01 bar/0.05 bar	[5]
0.78Pt/Al_2O_3	$1.43 \cdot 10^{-6}$	flow/(g); 60°C; H_2/B=1.01 bar/0.05 bar	[5]
0.95Pt/TiO_2	$4.97 \cdot 10^{-6}$	flow/(g); 60°C; H_2/B=1.01 bar/0.05 bar	[5]

SWCNT - single-walled carbon nanotubes
AC – activated carbon

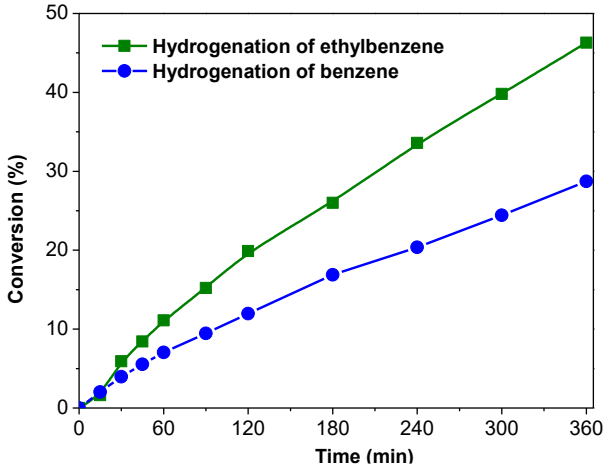

Figure S7. Comparison of the catalytic activity of 8.6Pt/*Y*-carbon(H_2) in the hydrogenation of benzene and ethylbenzene under identical conditions (10 bar H_2, 100 °C, 10 mg catalyst).

References

1. J. Lee, E. J. Jang and J. H. Kwak, *Appl Catal a-Gen*, 2019, **569**, 8-19.
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