Selective hydrogenolysis of furfural to 1,2-pentanediol over Pt-Fe/MT catalyst under mild conditions

Chen Cao, †[a,b] Weixiang Guan, †[a] Qiaoyun Liu,[c] Lin Li,[a] Yang Su,[a] Fei Liu,*[a] Aiqin Wang*[a] and Tao Zhang*[a]

[a]: *CAS Key Laboratory of Science and Technology on Applied Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian 116023, China. E-mail: fei.liu@dicp.ac.cn; aqwang@dicp.ac.cn; taozhang@dicp.ac.cn*

[b]: *University of Chinese Academy of Sciences, Beijing 100049, China.*

[c]: *College of Chemistry, Zhengzhou University, Zhengzhou, 450001, China.*

† These authors contributed equally.

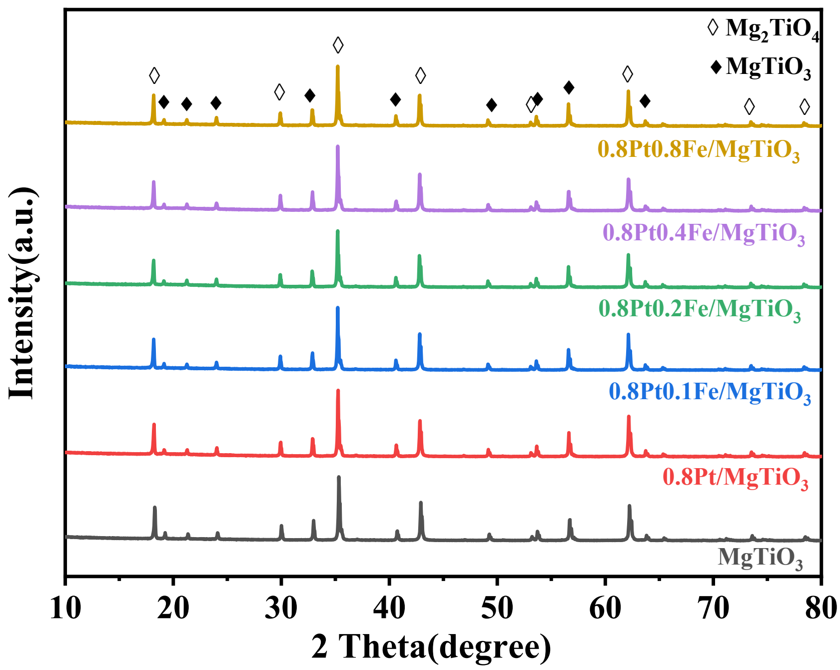

Figure S1 XRD patterns of the series of *x* Pt-*y* Fe/MT catalysts.

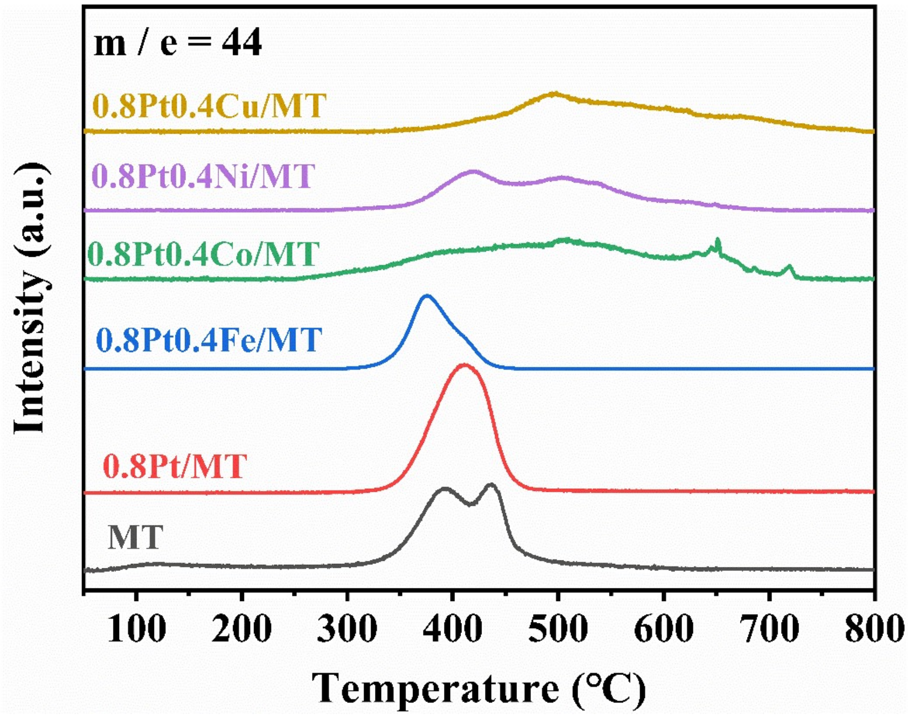

Figure S2 CO_2-TPD profiles for the MT, 0.8Pt/MT and 0.8Pt-0.4M/MT catalysts.

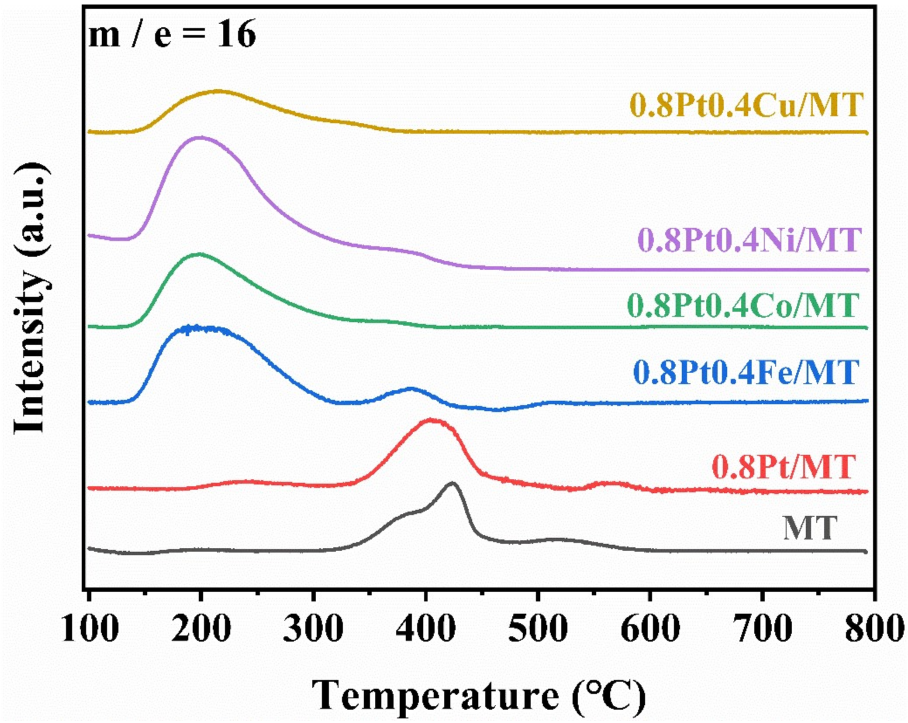

Figure S3 NH_3-TPD profiles for the MT, 0.8Pt/MT and 0.8Pt-0.4M/MT catalysts.

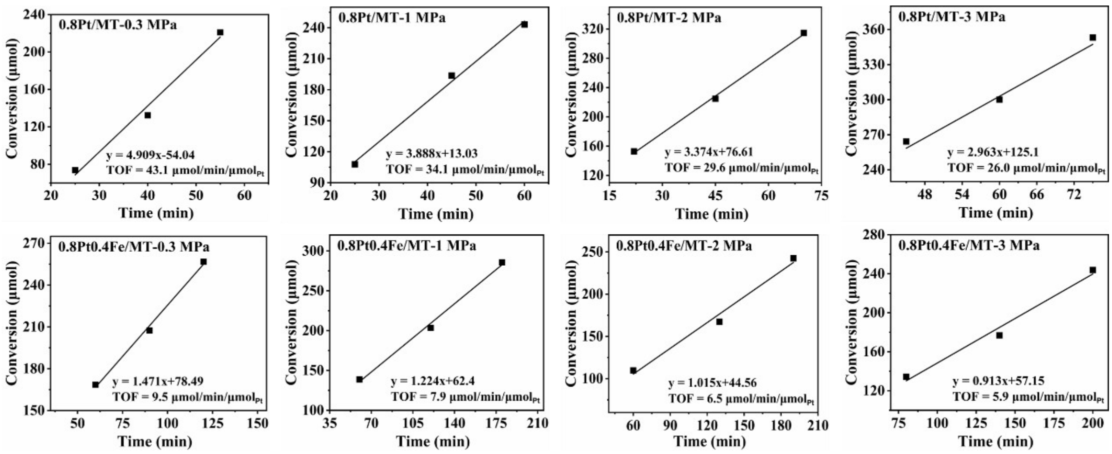

Figure S4 TOF values under different reaction pressure over 0.8Pt/MT and 0.8Pt0.4Fe/MT catalysts.

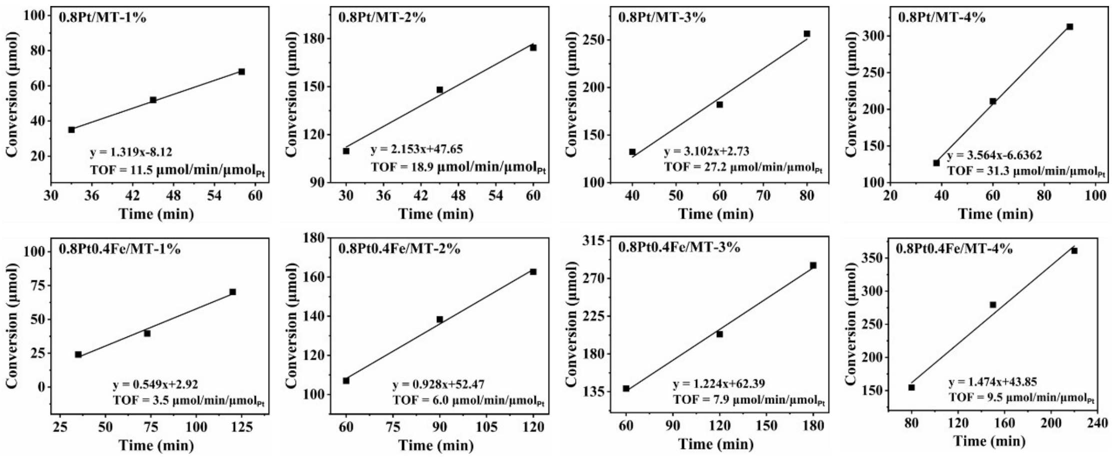

Figure S5 TOF values under different FFA concentration over 0.8Pt/MT and 0.8Pt0.4Fe/MT catalysts.

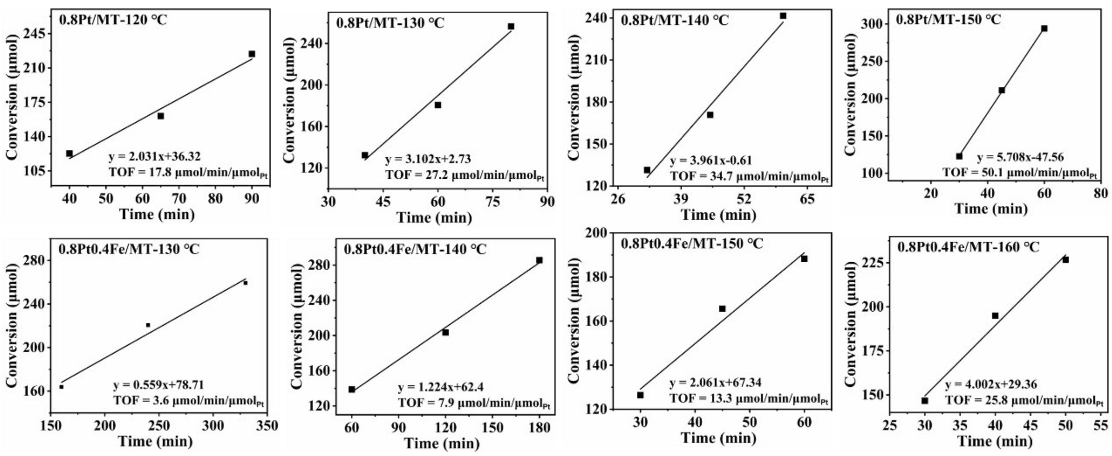

Figure S6 TOF values under different temperature over 0.8Pt/MT and 0.8Pt0.4Fe/MT catalysts.

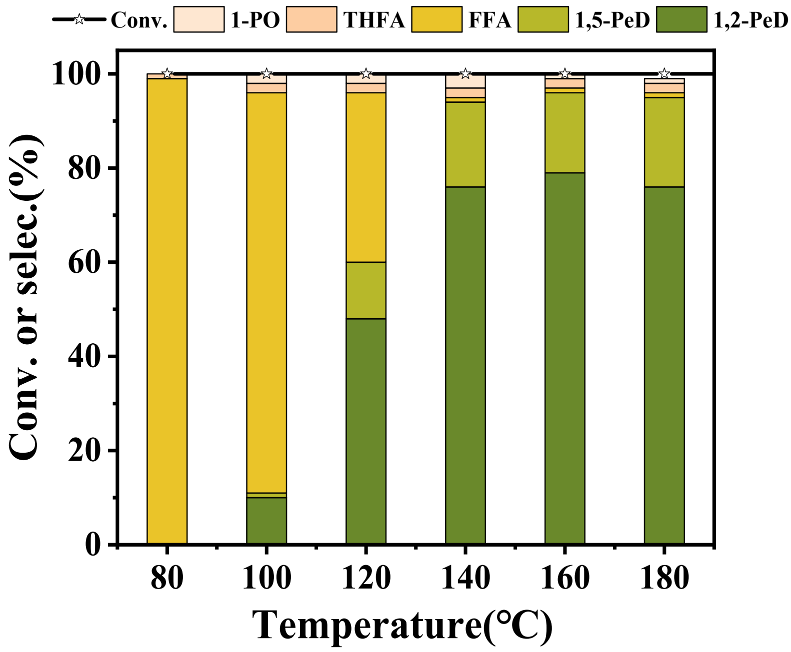

Figure S7 Catalytic performance under different temperature over 0.8Pt0.4Fe/MT catalyst. Reaction conditions:0.1 g FA in 5 g water, 100 mg catalyst, 1 MPa H_2, 10 h.

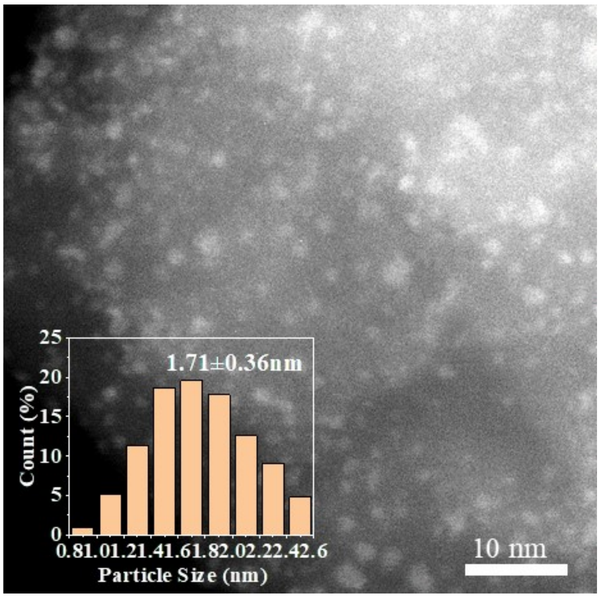

Figure S8 HAADF-STEM image of the 0.8Pt0.4Fe/MT-used catalyst.

Table S1 The amount of Mg^{2+} in the impregnation solution.

Catalyst	Concentration of Mg^{2+}
0.8Pt/MT	247.5 mg/L

Add 0.343 g of an aqueous solution of $H_2PtCl_6·6H_2O$ (Pt: 1.166 wt %) into a beaker, followed by the addition of water to achieve a total mass of 7 g, then introduce 0.5 g of MT. After stirring the mixture of metal precursor and support for 24 hours, it was filtered, and the filtrate was subjected to ICP testing. The leaching content of Mg is 0.3 wt %.

Table S2 The alkalinity and acidity of 0.8Pt0.4M/MT catalysts.

Catalysts	CO_2 uptake[a] ($\mu mol_{CO2}/g_{cat}$)	NH_3 uptake[b] ($\mu mol_{NH3}/g_{cat}$)
0.8Pt0.4Co/MT	22.3	13.2
0.8Pt0.4Ni/MT	25.8	19.9
0.8Pt0.4Cu/MT	18.7	7.7

[a] Determined by CO_2-TPD using a MS signal m / e = 44.

[b] Determined by NH_3-TPD using a MS signal m / e = 16

Table S3 Catalytic performance of the 0.8Pt0.4Fe/MT catalyst for the THFA hydrogenolysis.

Entry	Conversion (%)	Selectivity (%)	
		1,2-PeD	1,5-PeD
1	0	0	0

Reaction conditions: 0.1 g THFA in 5 mL H_2O, 100 mg catalyst, 1 MPa H_2 and 140 °C for 10 h.

Table S4 Comparison with the literature on the production rate of 1,2-PeD by hydrogenolysis of FA or FFA over noble metal catalyst.

Sub.	Cat.	T (°C)	P (MPa)	Time (h)	Sel. /%			Production rate ($mol_{1,2\text{-}PeD}$ / ($h*mol_{noble\ metal}$))	Ref
					THFA	1,2-PeD	1,5-PeD		
FFA	4Ru/MnOx	150	1.5	6	30	42.1	-	3.6	1
FFA	10Ru/Al_2O_3	200	10	1	57	32	-	20.4	2
FA	1Ru-5Sn/ZnO	140	3.5	6	0	84.5	12.4	168	3
FFA	5Ru/MgO	190	3	1	51	42	2.9	144	4
FA	20Ru/PVP	125	2	48	64	36	-	1.5	5
FA	3Pd/MMT-K	220	3.5	5	13	66	-	47	6
FA	1Rh/OMS-2	160	3	8	0	87	-	33	7
FA	1.9Pt/HT	150	3	4	14	73	8	19	8
FA	5Pt/CeO_2	165	1.5	4	22.8	59.9	3.1	6	9
FFA	4.5%Pt/CeO_2	165	2	24	11.7	77.1	7.3	3	10
FFA	1.67Pt/Mg(Al)O@ Al_2O_3-IR	200	3	0.12 h^{-1}	6	86	5	12.5	11
FA	0.8Pt0.4Fe/MT	140	0.1	10	2	81	15	53[a]	**This work**
FA	0.2Pt0.1Fe/MT	140	0.1	10	6	67	20	128[a]	
FA	0.1Pt0.05Fe/MT	140	0.1	10	2	43	17	178[a]	

[a]: These data were obtained after a reaction time of 2 h.

Table S5 The effect of solvents.[a]

Entry	Solvent	Conversion. (%)	Selectivity (%)				
			1,2-PeD	1,5-PeD	FFA	THFA	1-PO
1	Methanol	100	0	0	100	0	0
2	Ethanol	100	0	0	100	0	0
3	N, N-Dimethylformamide	100	0	0	100	0	0
4	Water	100	76	18	1	2	3

[a] Reaction conditions: 0.1 g of FA in 5 mL H_2O, 100 mg of 0.8Pt0.4Fe/MT, 1 MPa H_2, and 140 °C for 10 h.

Table S6 Catalytic performance of the 0.8Pt/MT and the 0.8Pt0.4Fe/MT catalyst for the furan and its derivatives hydrogenolysis.

Entry	Substrate	Catalyst	Selectivity (%)	
			Tetrahydrofuran	1-Butanol
1	Furan	0.8Pt/MT	47	53
2	Furan	0.8Pt0.4Fe/MT	15	85
3	2,5-Dihydrofuran	0.8Pt0.4Fe/MT	93	7
4	2,3-Dihydrofuran	0.8Pt0.4Fe/MT	90	10

Reaction conditions: 0.1 g of substrate in 5 g solvent (3 g H_2O and 2 g ethanol), 100 mg of catalyst, 1 MPa H_2, and 140 °C for 10 h.

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