Supplementary Material

Enhancing propane dehydrogenation performance of $PtSn/Al_2O_3$ catalyst by constructing spherical Al_2O_3 with hierarchical porous structure and high Al_V content

Gen Li[a, 1], Mutian Peng[a], Yixuan Wang[a], Yingda Chen[a], Jiasheng Kou[a], Kang Wang [b, *] and Xitao Wang [a, *]

*Corresponding Authors,

E-mail address: wangk72@tju.edu.cn (Kang Wang); wangxt@tju.edu.cn (Xitao Wang).

a. Tianjin Key Laboratory of Applied Catalysis Science and Technology, School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, China.

b. Tianjin Key Laboratory of Membrane Science and Desalination Technology, Chemical Engineering Research Center, School of Chemical Engineering and Technology, Tianjin University, Tianjin 300072, China.

Table S1.
The mechanical strength of supports.

AlMOF content	0 wt%	10 wt%	15 wt%	20 wt%	25 wt%
The strength of AlOOH(xAlMOF) (N/bead)	105.3	88.5	80.3	75.0	68.2
The strength of Al_2O_3@C(xAlMOF) (N/bead)	60.9	50.2	43.8	41.1	35.2
The strength of Al_2O_3(xAlMOF) (N/bead)	56.2	33.5	28.4	25.5	14.8

Table S2.
Peaks and fraction of O 1s and Pt 4d of the samples.

Supports	Peak area fraction (%)		
	O 1s		
	Lattice oxygen	Defect-associated oxygen	Hydroxyl oxygen
Al_2O_3	30.9	32.0	37.1
Al_2O_3(0.1AlMOF)	25.7	36.4	37.9
Al_2O_3(0.2AlMOF)	20.4	40.0	39.6
Al_2O_3(0.25AlMOF)	24.9	36.7	38.4
PtSn/Al_2O_3	33.6	30.8	35.6
PtSn/Al_2O_3(0.2AlMOF)	31.9	29.4	38.7

Catalysts	Pt $4d_{5/2}$			Pt $4d_{3/2}$		
	Pt^0	Pt^{2+}	Pt^{4+}	Pt^0	Pt^{2+}	Pt^{4+}
	Binding energy (eV)					
PtSn/Al_2O_3	306.9	312.5	317.2	327.7	330.6	335.1
PtSn/Al_2O_3(0.2AlMOF)	308.1	313.6	318.9	332.8	335.7	338.8
	Peak area fraction (%)					
PtSn/Al_2O_3	38.0	36.8	25.2	28.4	30.3	41.3
PtSn/Al_2O_3(0.2AlMOF)	32.4	41.9	25.7	23.9	34.3	41.8

Table S3.

The activity measurement results of catalysts.

Catalysts	Conversion of propane (%)	Selectivity of propylene (%)	Yield of propylene (%)
	Initial/Final	Initial/Final	Initial/Final
$PtSn/Al_2O_3$	32.7/30.0	88.8/93.1	29.1/27.9
$PtSn/Al_2O_3$(0.1AlMOF)	37.5/31.9	89.2/93.2	33.4/29.7
$PtSn/Al_2O_3$(0.15AlMOF)	40.2/32.8	89.8/94.0	36.2/30.8
$PtSn/Al_2O_3$(0.2AlMOF)	42.3/34.0	90.3/93.9	38.2/32.0
$PtSn/Al_2O_3$(0.25AlMOF)	30.8/27.0	89.5/92.0	27.5/24.8
First cycle of $PtSn/Al_2O_3$(0.2AlMOF)	42.2/34.0	90.1/93.9	38.0/31.9
Second cycle of $PtSn/Al_2O_3$(0.2AlMOF)	42.2/33.9	89.7/93.7	37.9/31.8
Third cycle of $PtSn/Al_2O_3$(0.2AlMOF)	41.8/33.3	90.0/93.3	37.6/31.1
Fourth cycle of $PtSn/Al_2O_3$(0.2AlMOF)	41.7/33.1	90.8/93.6	37.9/31.0
Fifth cycle of $PtSn/Al_2O_3$(0.2AlMOF)	41.2/33.1	90.7/93.6	37.4/31.0