Electronic Supplementary Information

Boron Nitride Nanosheet Supported Pt/Cu cluster as High-Efficiency Catalyst for Propane Dehydrogenation

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1. Supplementary Figures

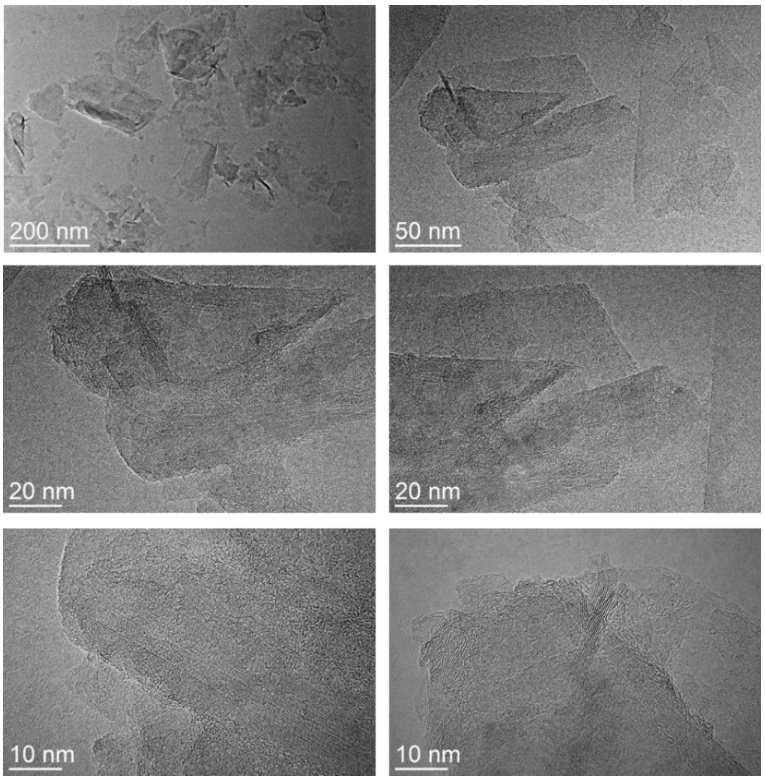

Fig. S1 HR-TEM images of the *h*-BN-sheet support.

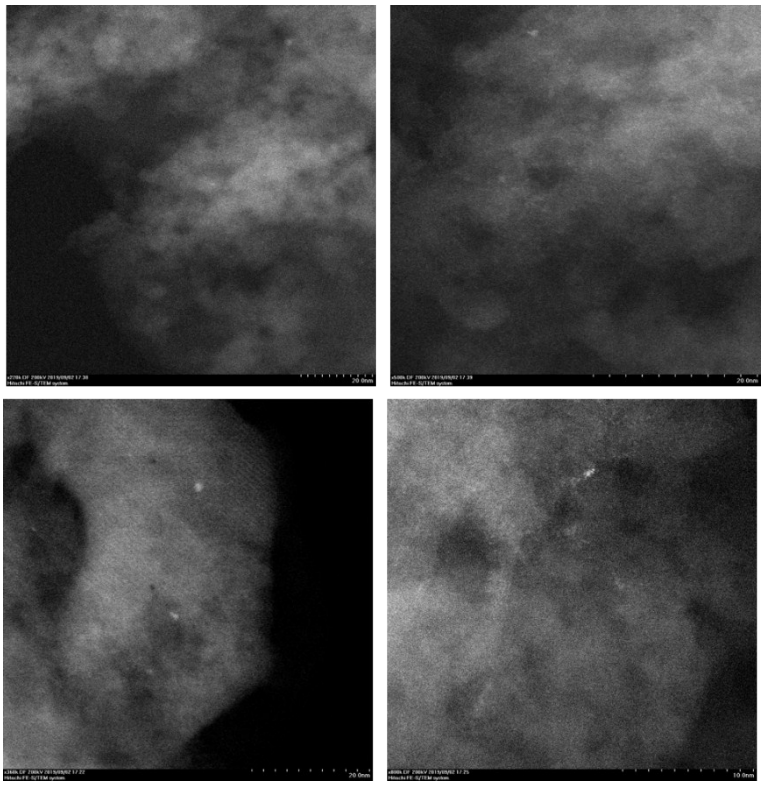

Fig. S2 Aberration-corrected HAADF-STEM images of the Pt/Cu/*h*-BN-sheet catalyst.

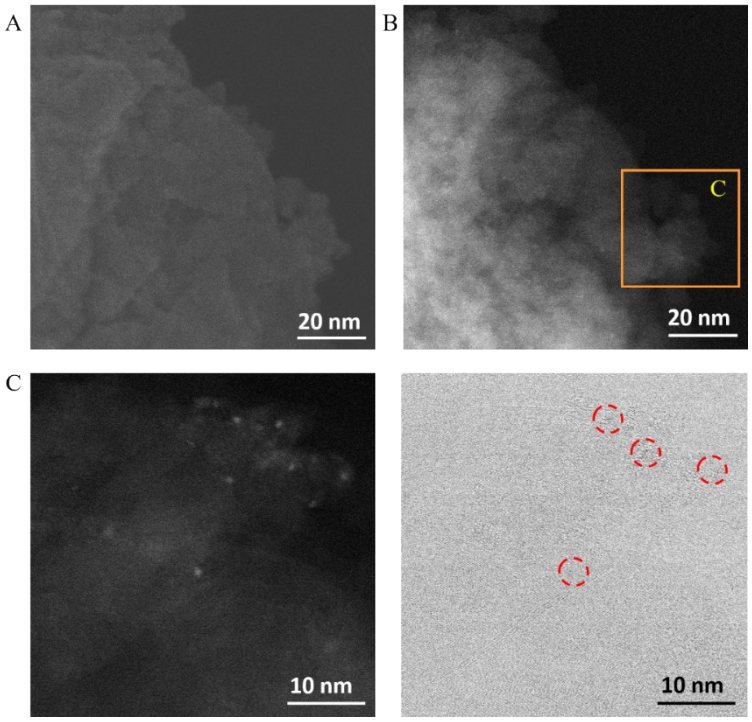

Fig. S3 (A) SEM image, (B) aberration-corrected HAADF-STEM image, (C) ADF-STEM (Left) and BF-STEM (Right) images of the Pt/Cu/*h*-BN-sheet catalyst.

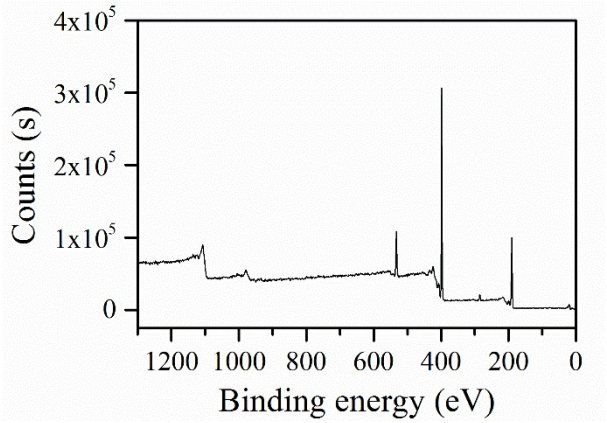

Fig. S4 XPS survey of the Pt/Cu/*h*-BN-sheet catalyst.

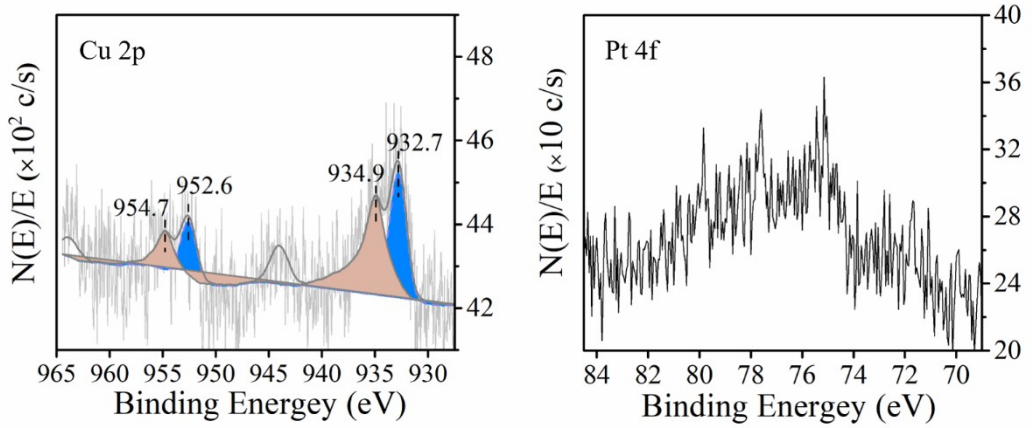

Fig. S5 The XPS spectra of Cu 2p and Pt 4f in the Pt/Cu/*h*-BN-sheet catalyst.

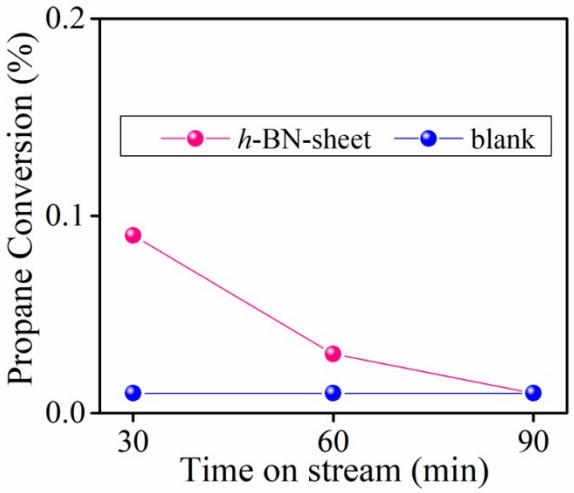

Fig. S6 The testing results of *h*-BN-sheet and blank in propane dehydrogenation. Reaction conditions: feed gas, 17.1 kPa C_3H_8, 17.1 kPa H_2, and N_2 balance; space velocity, 4.0 g_{C3H8} g_{cat}^{-1} h^{-1}; atmospheric pressure.

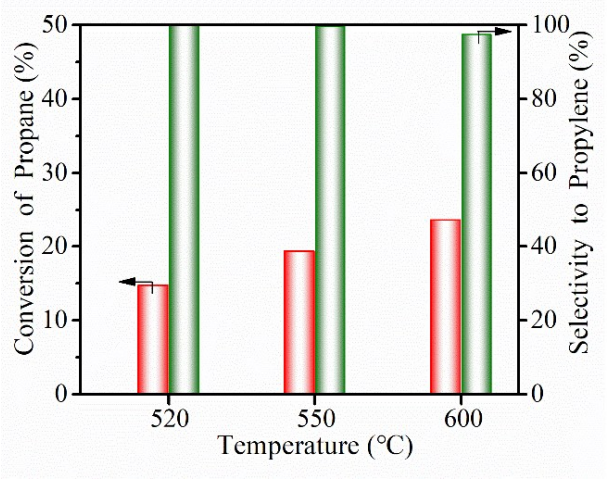

Fig. S7 The effect of reaction temperature on the initial conversion of propane and propylene selectivity in propane dehydrogenation. Reaction conditions: catalyst weight, 100 mg; feed gas, 17.1 kPa C_3H_8, 17.1 kPa H_2, and N_2 balance; space velocity, 4.0 g_{C3H8} g_{cat}^{-1} h^{-1}; atmospheric pressure.

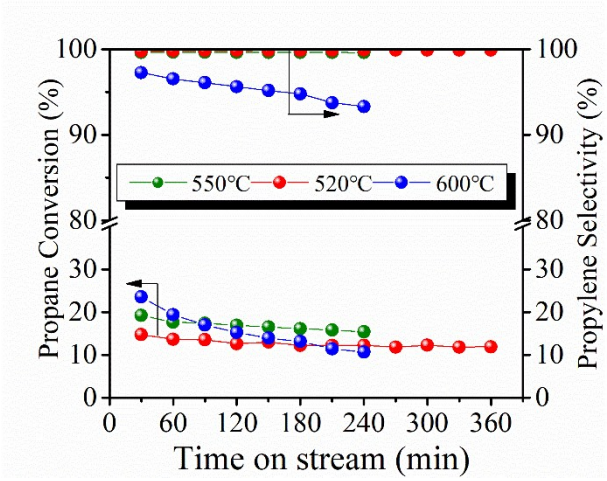

Fig. S8 Propane conversion and propylene selectivity as a function of reaction time in propane dehydrogenation. Reaction conditions: catalyst weight, 100 mg; feed gas, 17.1 kPa C_3H_8, 17.1 kPa H_2, and N_2 balance; space velocity, 4.0 g_{C3H8} g_{cat}^{-1} h^{-1}; atmospheric pressure.

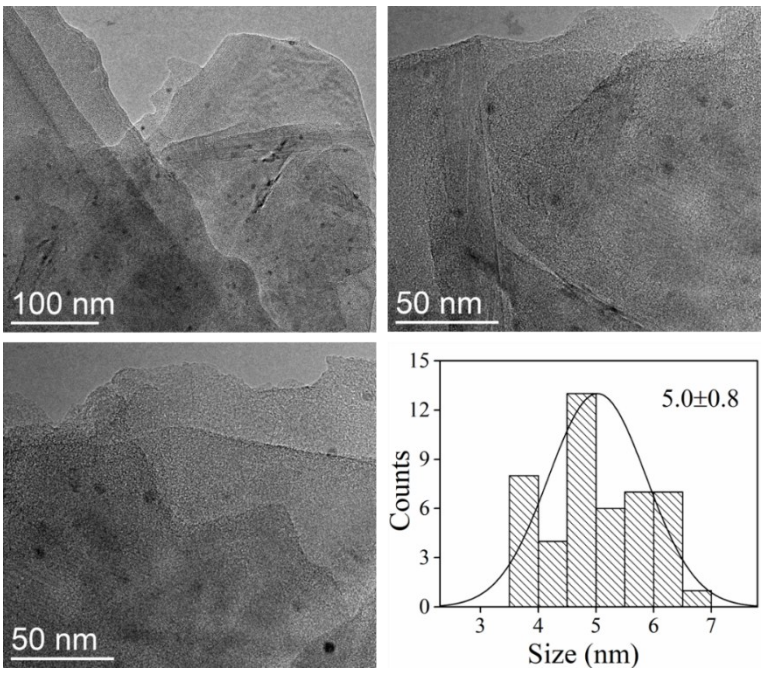

Fig. S9 HR-TEM images and the distribution of particle size of the spent catalysts.

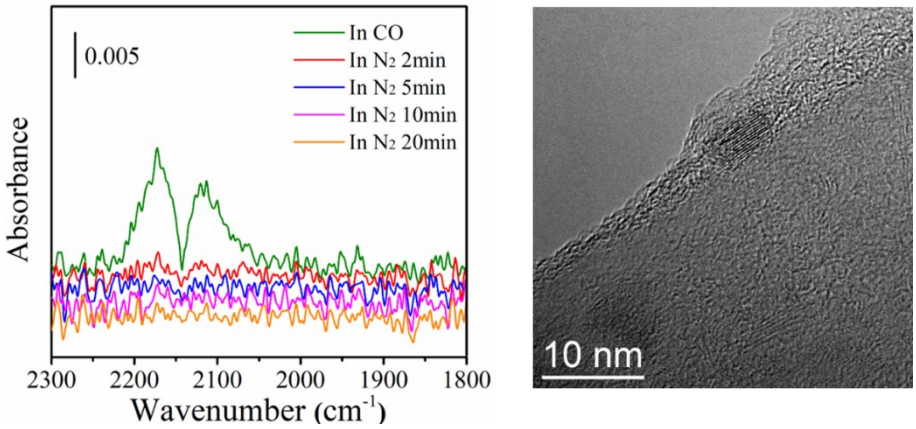

Fig. S10 CO-DRIFT spectra (Left) and HR-TEM image (Right) of the spent Pt/Cu/*h*-BN-sheet catalyst.

2. Supplementary Table

Table S1. Summary for catalytic performances of propane dehydrogenation over the typical platinum catalysts reported in literature.

Ref.	Catalysts	Feed gas [kPa]	Temp [°C]	SV [h^{-1}]	$X(C_3H_8)$ [%]		$S(C_3H_6)$ [%]		Specific activity [$mol_{C3H6}\ mol_{Pt}^{-1}\ s^{-1}$]
					Initial	Final	Initial	Final	
1	0.10wt% $Pt/Cu/Al_2O_3$	C_3H_8: 16 H_2: 16	520	4.0	13.1	12.4	87	89	0.56
2	1wt%$Pt/Cu/MgAl_2O_4$	C_3H_8:47.5 H_2: 47.5	580	6.8	25.7	21.0	87.5	93.1	0.79
3	0.1wt%Pt/Zn/HZSM5	C_3H_8: 5	525	0.4	52.5	46.0	85.5	94.0	0.22
4	0.75wt% Pt/Fe@Pt/SBA-15	C_3H_8: 26 H_2: 26	600	3.5	35.0	30.0	85.0	96.0	0.15
5	1.0wt% $Pt/Sn/CeO_2$	C_3H_8: 4.0 H_2O: 0.01	680	2.4	45.0	34.0	80.0	86.0	0.10
6	1.0wt%Pt/In/SSF	C_3H_8: 20	580	4.05	46.9	40.9	98.0	99.0	0.20
7	0.6wt%Pt/In/Mg(Al)O	C_3H_8: 16 H_2: 14	620	3.3	61.7	58.9	96.4	96.6	0.38
8	0.7wt% Pt/Mg(In)(Al)O	C_3H_8: 20 H_2: 25	600	2.6	20.4	16.3	96.0	98.0	0.18
9	0.35wt% $Pt/Sn/Al_2O_3$	C_3H_8:16 H_2: 20	590	9.4	48.7	44.6	97.5	99.1	1.58
10	0.5wt%Pt/Mg(Sn)(Al)O@Al_2O_3	C_3H_8:25.6 H_2:14.3	550	14	29.4	27.8	93.7	99.2	0.96
			600		48.3	43.0	86.4	98.1	1.46
11	0.3wt% $Pt/Sn/K/\theta$-Al_2O_3	C_3H_8: 66.7 H_2:33.3	600	4	39.9	38.2	92.0	95.5	0.60
12	0.5wt%Pt/Sn/TS-1	C_3H_8: 16.7 H_2: 16.7	590	3	53.5	47.7	92.5	93.0	0.40
13	0.1wt% $Pt/Ga/K/Al_2O_3$	C_3H_8: 100	620	10.6	46.0	35.0	96.0	92.0	0.58
14	0.5wt%Pt/Sn/Na/SUZ-4	C_3H_8: 25 H_2: 75	590	3	24.0	22.0	90.0	91.0	0.16
15	0.5wt%Pt/Zn/Na-Y	C_3H_8: 100	550	2.6	24.8	15.7	91.6	90.6	0.15

Note: SV, space velocity, grams of propane per gram of catalyst per hour; $X(C_3H_8)$, propane conversion; $S(C_3H_6)$, propylene selectivity; specific activity, moles of propylene formed per mole of platinum atom per second.

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