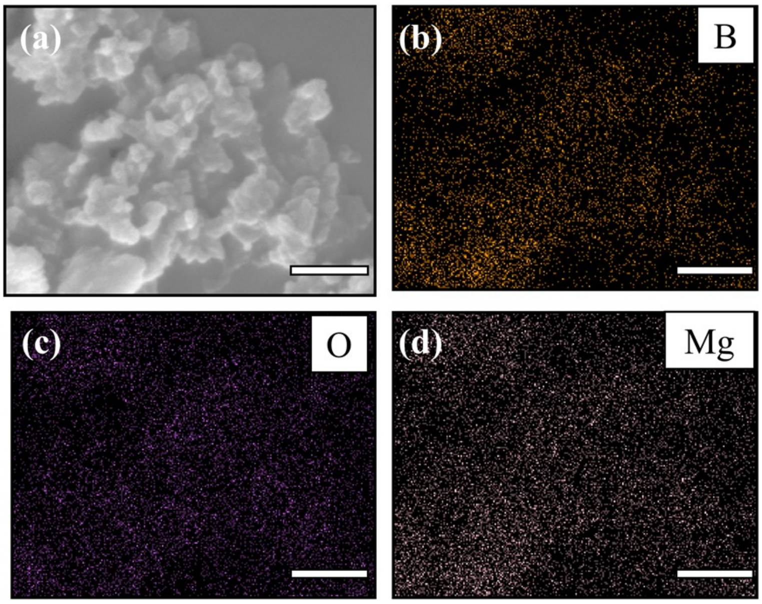

Figure S1. (a) SEM image of Mg-BNSs. (b-d) EDX mapping of Mg-BNSs. Scale bars, 200 nm.

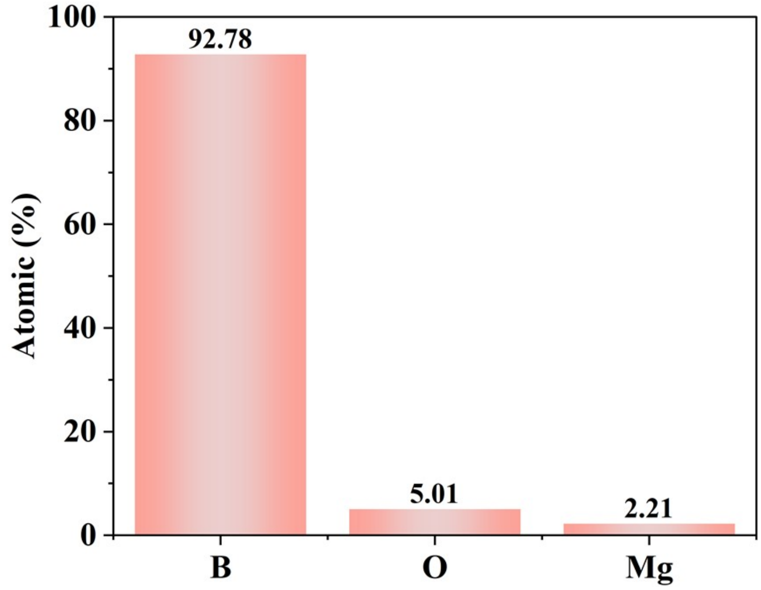

Figure S2. EDX analysis results of Mg-BNSs.

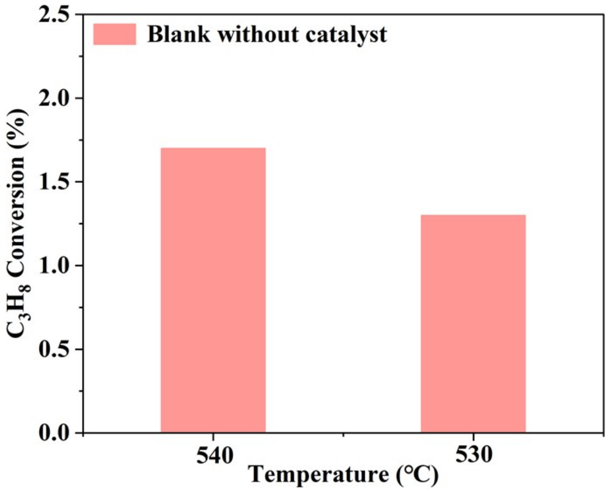

Figure S3. The blank without catalyst test for ODHP. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

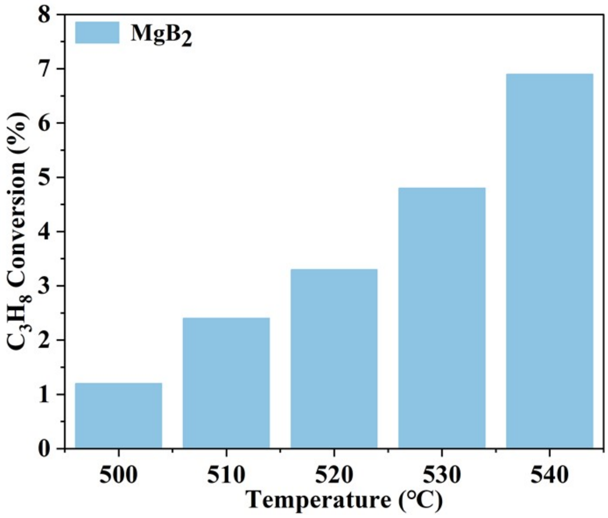

Figure S4. Catalytic performance of MgB_2 at different temperatures. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

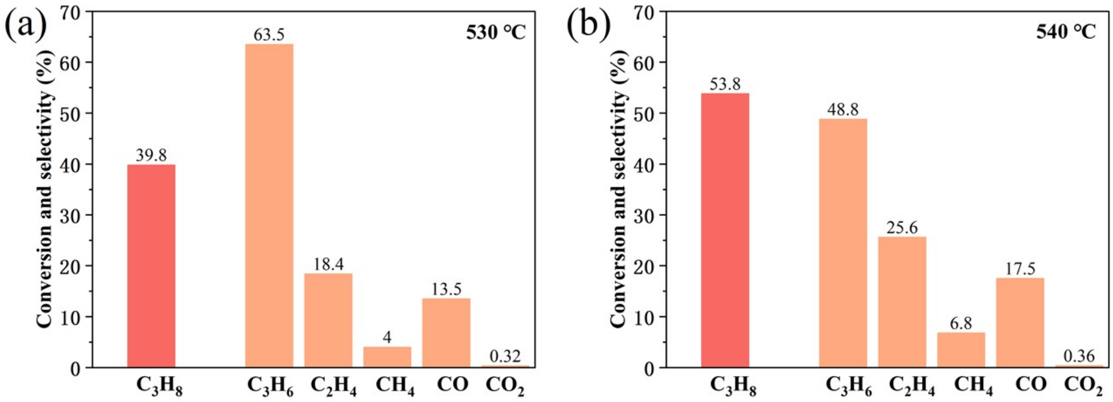

Figure S5. Propane conversions and product selectivities of Mg-BNSs at 530 ℃ and 540 ℃. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

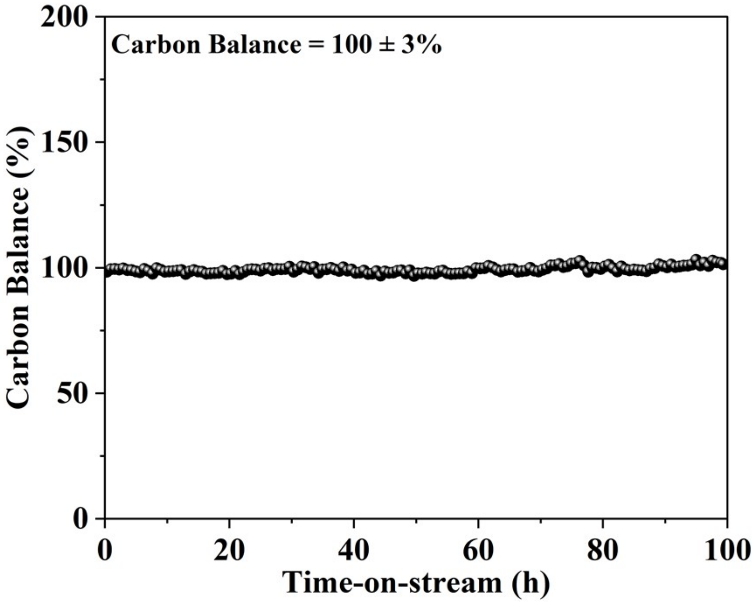

Figure S6. Carbon balance of Mg-BNSs during the stability test at 530 ℃.

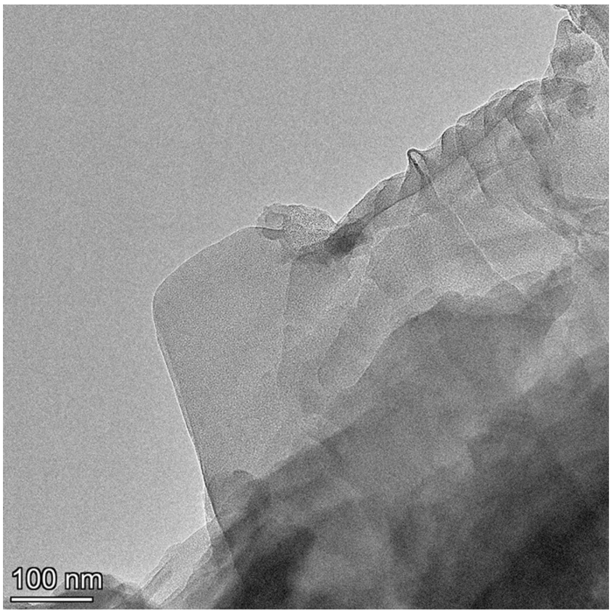

Figure S7. TEM image of Mg-BNSs after the catalytic test for 100 h.

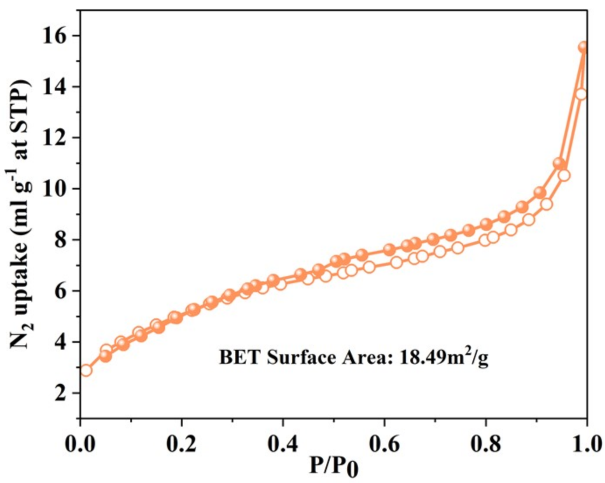

Figure S8. N_2 sorption isotherms of Mg-BNSs after the catalytic test for 100 h.

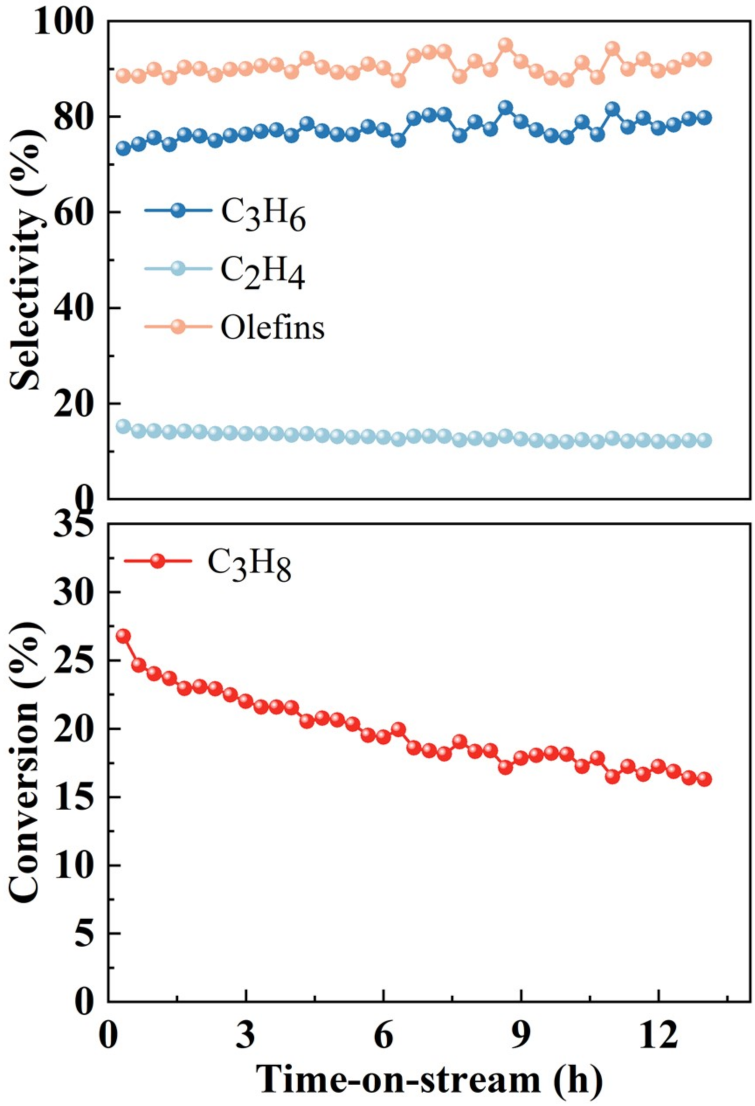

Figure S9. Long-term stability test of h-BN at 530 ℃. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

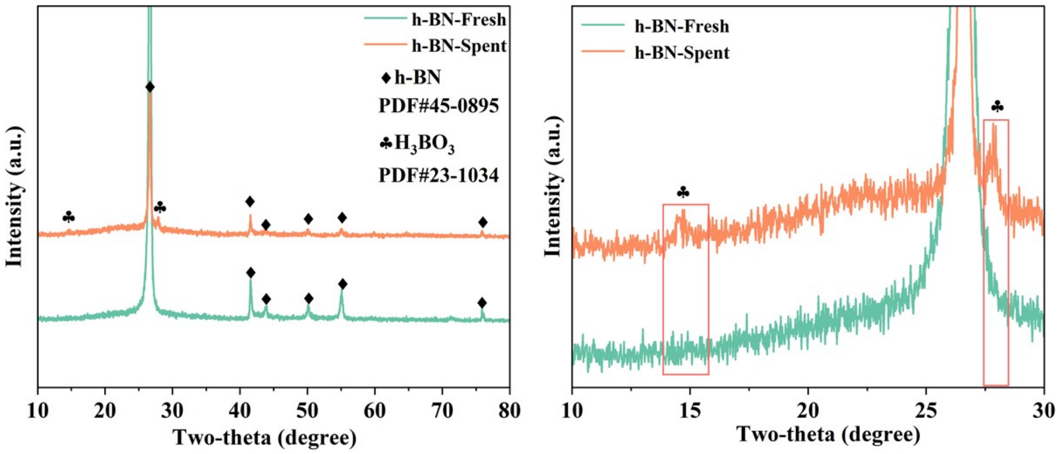

Figure S10. XRD patterns of the fresh h-BN and the spent h-BN.

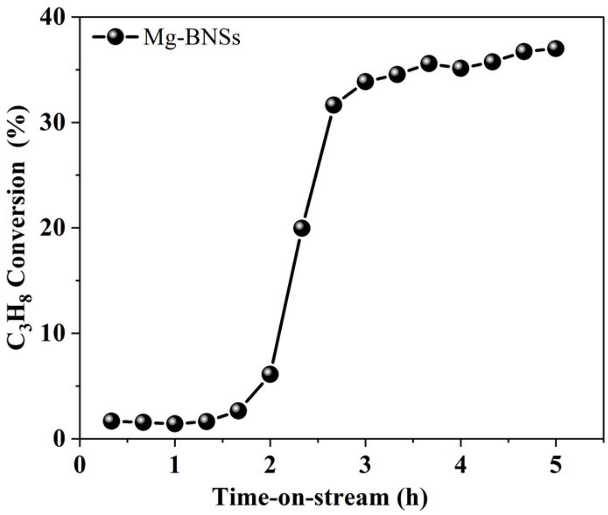

Figure S11. Propane conversion as a function of time on stream on the fresh Mg-BNSs at 530 ℃. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

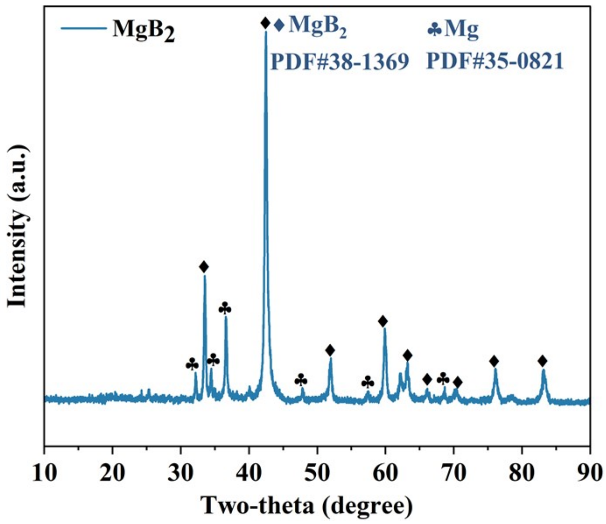

Figure S12. XRD pattern of commercial MgB_2.

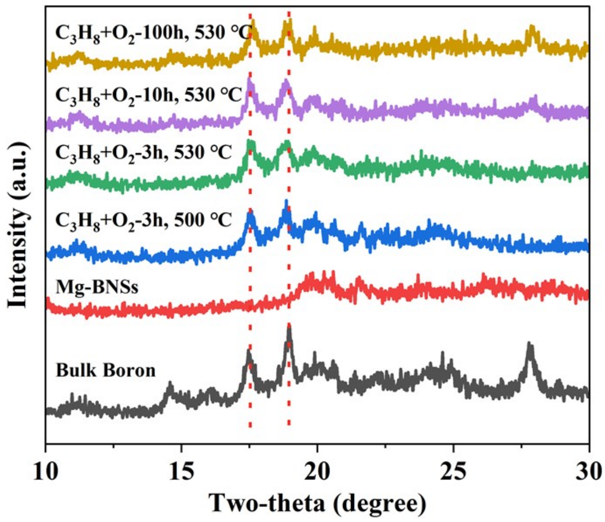

Figure S13. Selected regions of the XRD patterns of bulk boron, Mg-BNSs and their spent forms.

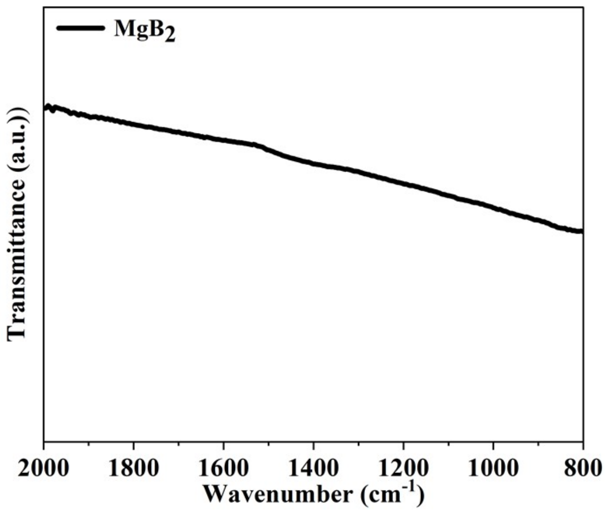

Figure S14. FT-IR spectrum of MgB_2.

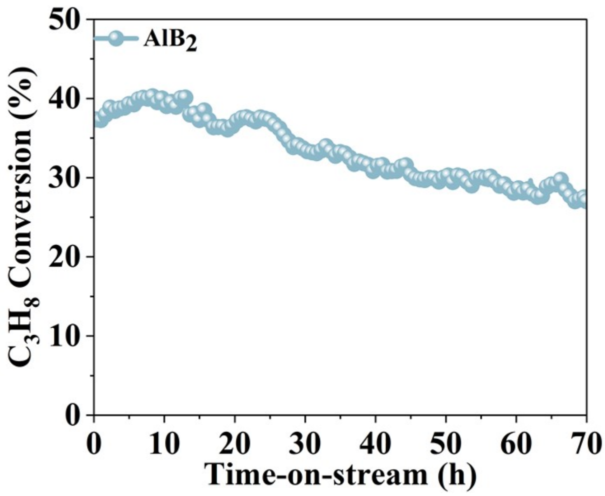

Figure S15. Propane conversion as a function of time on stream on the pristine AlB_2 at 530 °C. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

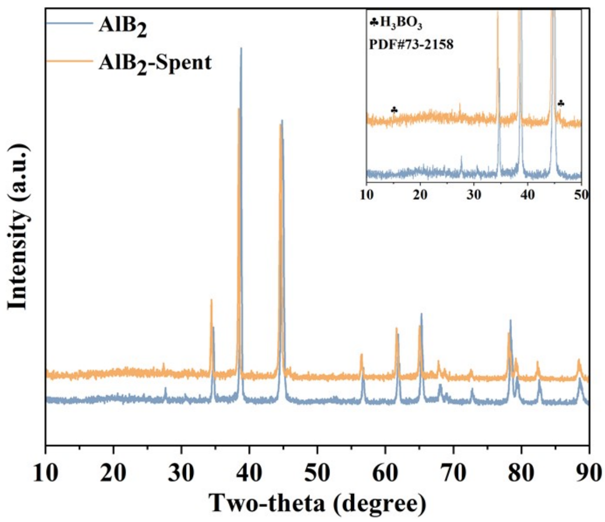

Figure S16.XRD pattern of AlB_2 and the spent AlB_2.

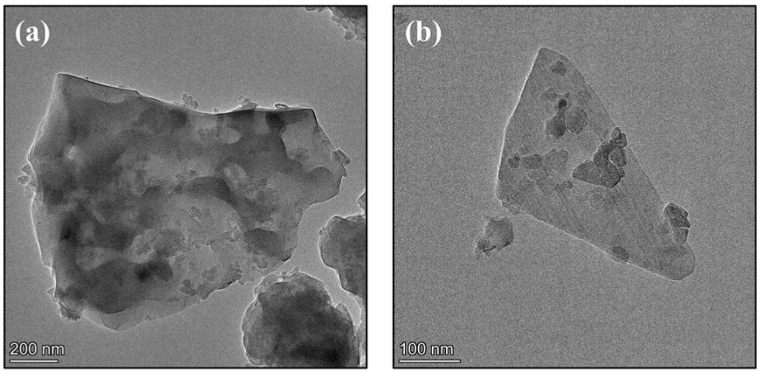

Figure S17. TEM images of (a) AlB_2 and (b) Al-BNSs.

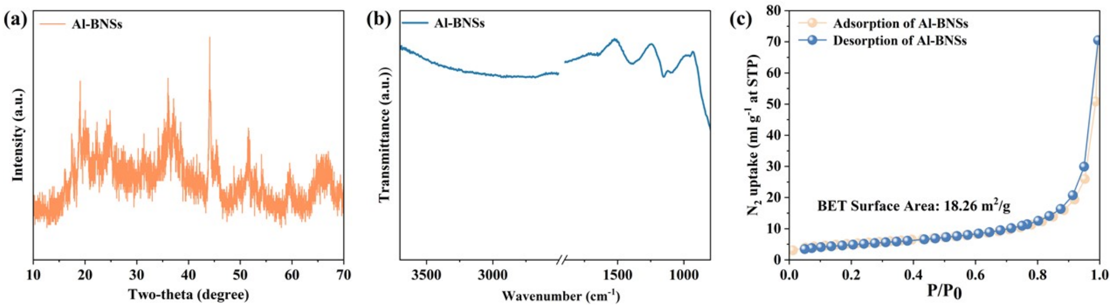

Figure S18. (a) XRD pattern, (b) FT-IR spectrum and (c) N_2 adsorption and desorption studies of Al-BNSs.

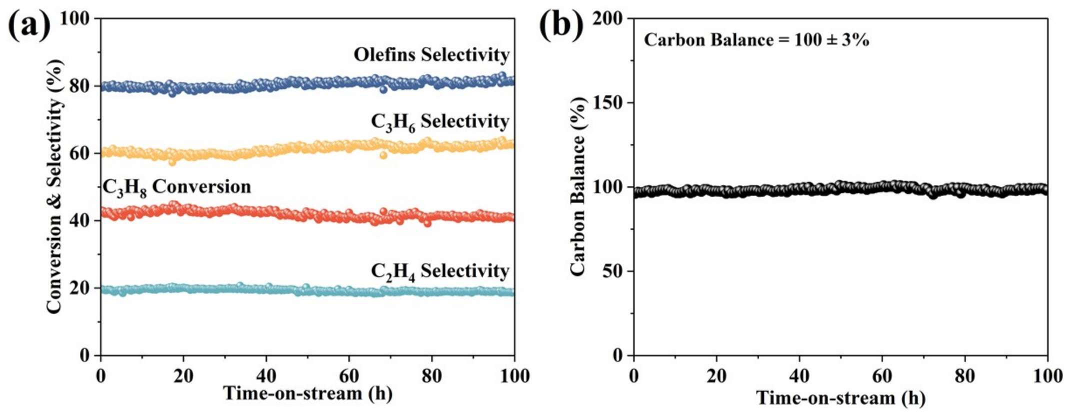

Figure S19. (a) Stability test of Al-BNSs at 530 °C over 100 h. (b) Carbon balance of Al-BNSs during the stability test at 530 °C. Reaction conditions: atmospheric pressure, $C_3H_8/O_2/N_2$ ratio = 1 :1 :3, WHSV = 24000 ml/g/h.

Table S1. ICP-OES analysis results of Mg-BNSs.

Sample	**ICP-AES value (mg/L)**		**Stoichiometric ratio**
	Mg	**B**	**Mg:B**
MgB_2-HCl	**1.16**	**8.57**	**$Mg_{0.12}B_2$**

Note: the stoichiometric ratio was calculated by using the following formula:

$$\frac{Elemental\ concentration\ of\ Mg}{Atomic\ weight\ of\ Mg\ (24.3)} : \frac{Elemental\ concentration\ of\ B}{Atomic\ weight\ of\ B\ (10.8)}$$

Table S2. Elements compositions of MgB_2, Mg-BNSs, and the spent Mg-BNSs based on XPS analysis results.

Samples	**B (at.%)**	**Mg (at.%)**	**O (at.%)**
MgB_2	17.81	16.73	65.46
Mg-BNSs-Fresh	80.57	1.61	17.82
Mg-BNSs-Spent	42.64	2.40	54.96

Table S3. Catalytic performance of Mg-BNSs in comparison with the reported boron-based catalysts in ODHP.

No.	Catalysts	Temp. [°C]	Conv. [%]	Selectivity [%]			Productivity [g_{olefin} g_{cat}^{-1} h^{-1}]	Ref.
				$C_3^=$	$C_2^=$	$C_{2-3}^=$		
1	WB	500	2.5	87.9	7.3	95.2	0.13	1
2	NiB	500	6.1	85.4	9.3	94.7	0.40	1
3	Ti_2B	500	5.8	85.4	9.1	94.5	0.50	1
4	B_4C	500	7.0	84.2	9.3	93.5	0.60	1
5	h-BN	490	14	79.0	12.0	91.0	0.50	2
6	High surface area BN	525	24	69.0	-	-	0.04	3
7	BS-1	540	23.8	55.4	27.2	82.6	0.12	4
8	B_2O_3/Al_2O_3	550	24.1	42.6	12.5	55.1	0.35	5
9	BOS-10	450	14.8	73.3	14.1	87.4	1.1	6
10	B_2O_3@BPO_4	550	24.7	66.4	18.4	84.8	0.79	7
11	SiB_6	535	19.2	82.2	12.2	94.4	1.49	8
12	B-MWW	540	29.9	72.5	15.3	87.8	1.11	9
13	Mg-BNSs	530	39.8	63.5	18.4	81.9	2.48	This work
14	Mg-BNSs	540	53.8	48.8	25.6	74.4	2.91	This work

Table S4. The prices of MgB_2 and AlB_2 from different resources.

Samples	Yield of boron nanosheet (wt%)	Cost (CNY/g)
MgB_2	27.0	1.2
AlB_2	24.3	9.5

Note: The price was calculated based on the price of MgB_2 from RHAWN (30.73 CNY/25g) as of when this work was submitted. And the price of AlB_2 from Acmec (47.55 CNY/5g) as of when this work was submitted.

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