Supplementary Material

Enhancing the Activity of Supported Rhenium-catalyzed Cross-Metathesis of Ethene and 2-Butene *via* promotion of boron

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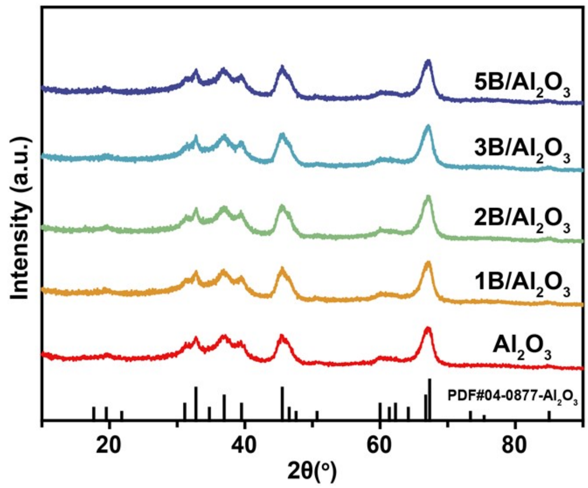

Fig. S1. XRD patterns of xB/Al_2O_3 supports.

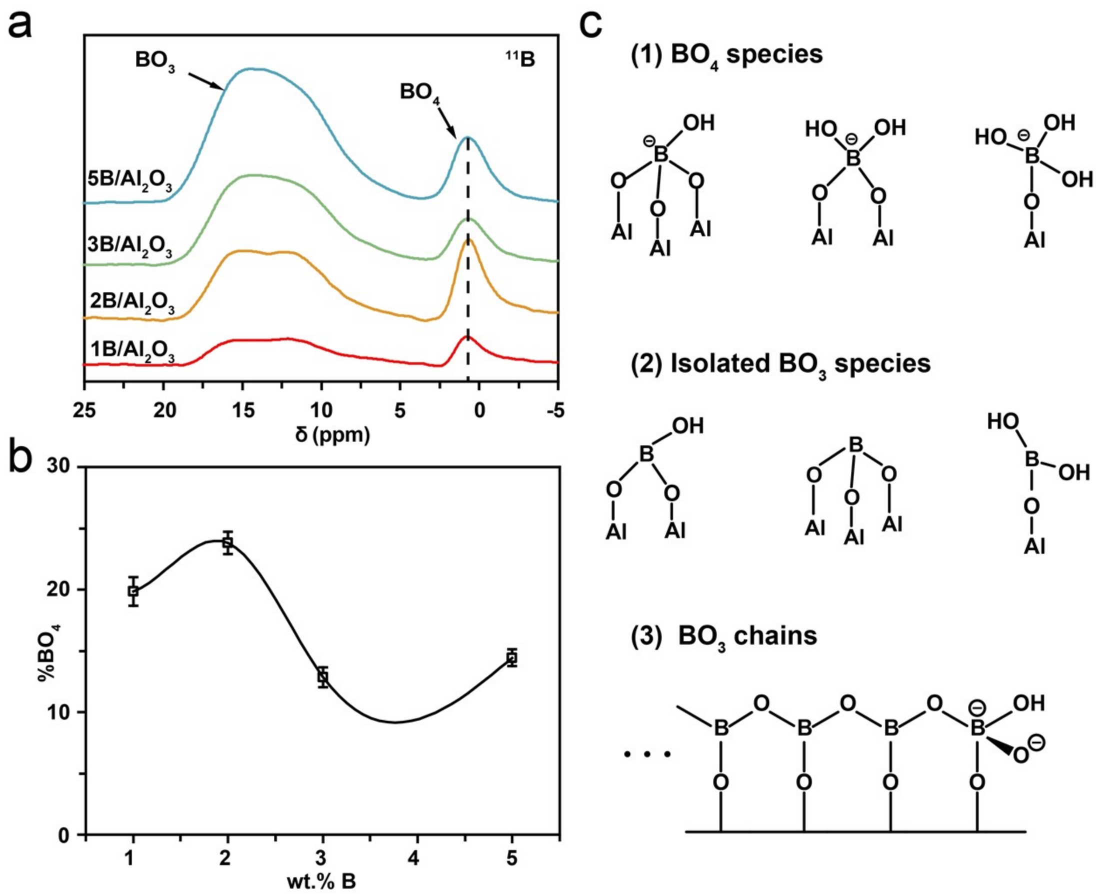

Fig. S2. (a) ^{11}B MAS-NMR spectra illustrating the spectral region for the central transitions for the xB/Al_2O_3 supports. (b) The fraction of BO_4 species determined as $I(BO_4)/\{I(BO_4)+I(BO_3)\}$, as a function of the total boron content for the xB/Al_2O_3. (c) Schematic structures of BO_x species on an alumina surface.

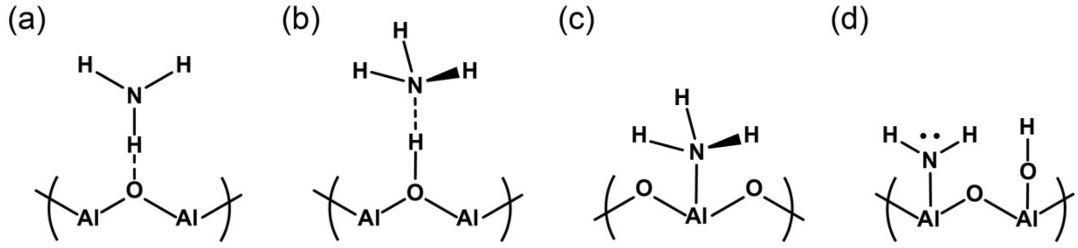

Fig. S3. Ammonia adsorption modes on acid sites: (a) Ammonia forms hydrogen bonds with surface oxygen atoms through its hydrogen (H) atoms. This is the weakest interaction mode. (b) Proton transferred from the surface hydroxyl group acting as a Brønsted acid site to the adsorbate. (c) The nitrogen atom of NH_3 coordinates with aluminum ions, which act as Lewis acid sites. (d) NH_3 undergoes dissociative adsorption, simultaneously forming a hydroxyl group, which stabilizes NH_3 on the solid surface.

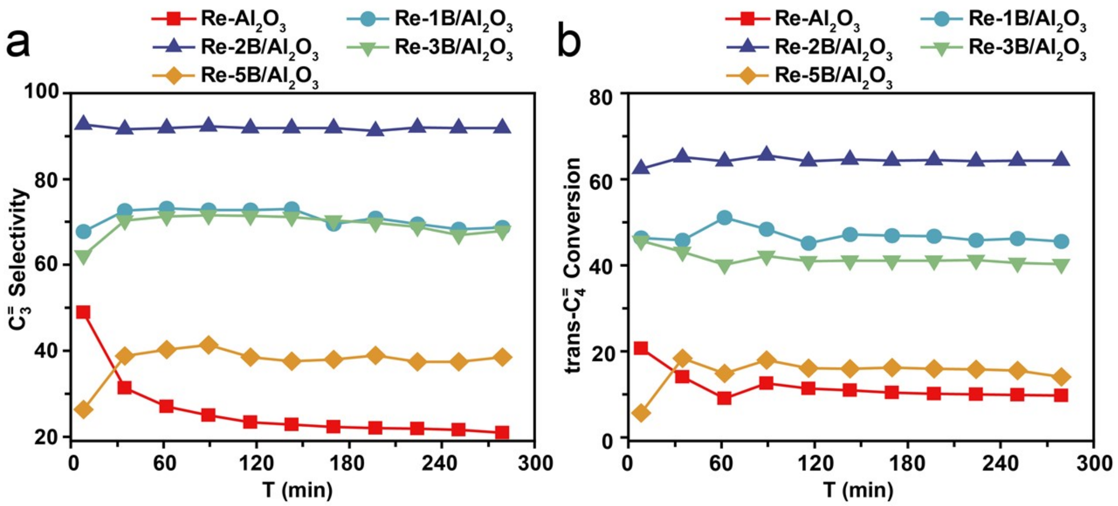

Fig. S4. (a) Time-on-stream selectivity of propene for Re-xB/Al_2O_3 catalyzed metathesis of $C_2^=$ and trans-2-$C_4^=$. (b) Time-on-stream conversion of 2-Butene for Re-xB/Al_2O_3 catalyzed metathesis of $C_2^=$ and trans-2-$C_4^=$.

Table S1. Comparison on the catalytic performance of metathesis over different rhenium catalysts.[1-5]

Catalyst	Substrates	TOF/h^{-1}	Reference
Re-2B/Al_2O_3	ethane and 2-butene	96.2	This work
Re-SiO_2-Al_2O_3	ethane and 2-butene	64.1	*ACS Catal., 2021, 11, 3530−3540*
Re-ZSM-5	propene	12.2	*ACS Catal.*, 2021, 11, 2412−2421
Re/AlMCM-41	ethane and 2-butene	46.8	*Catalysts.,* 2022, 12, 188.
Re-SiO_2-Al_2O_3-Cl	1-octene	10	*J. Catal.*, 2008, 258, 61-70.
Re/meso-Al_2O_3	1-octene	39.7	*Microporous Mesoporous Mater.*, 2004, 74, 93-103.

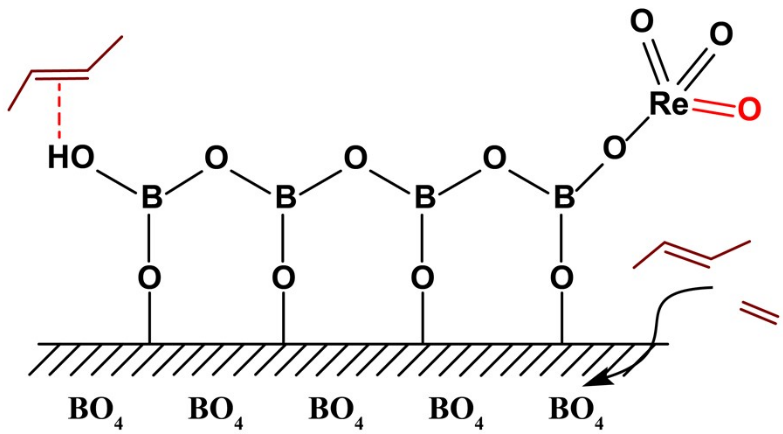

Fig. S5. The illustrative diagram on the ReO_x-B sites with high boron loading.

Notes and references

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