Supplementary material

Microwave-assisted ethanol dehydration to ethylene over biochar-based catalyst at low temperature

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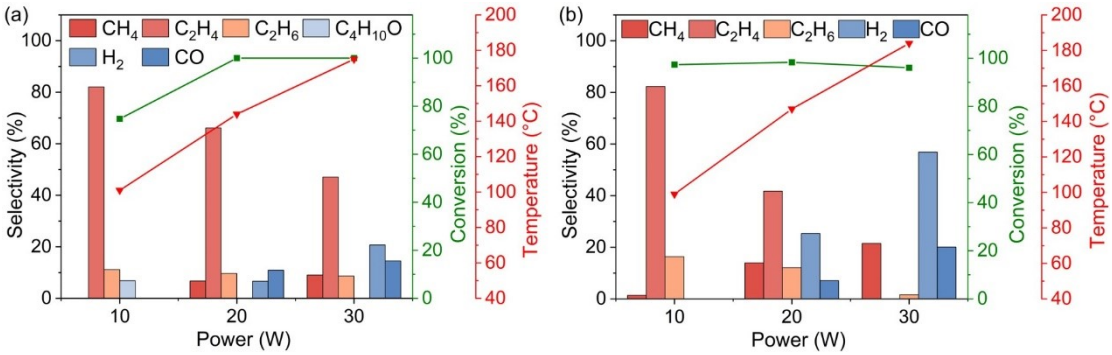


Fig. S1 Product selectivity and ethanol conversion over (a) HBC-1.5 and (b) HBC-2 with different microwave input powers.

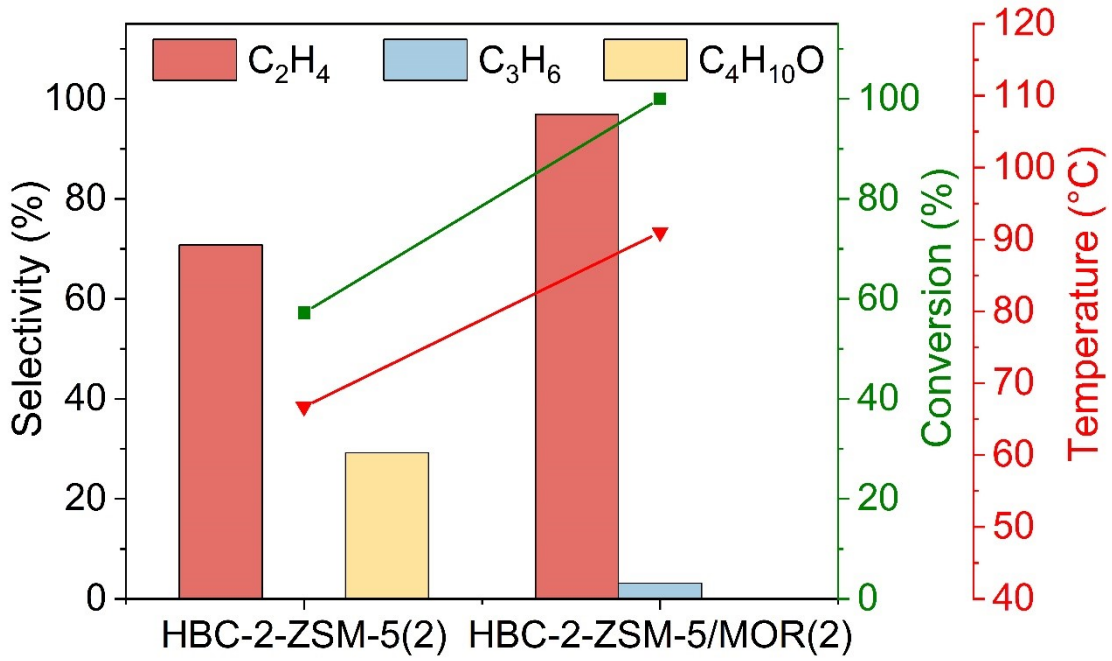


Fig. S2 Product selectivity and ethanol conversion over HBC-2-ZSM-5 (2) and HBC-2-ZSM-5/MOR (2) with 10 W microwave input powers.

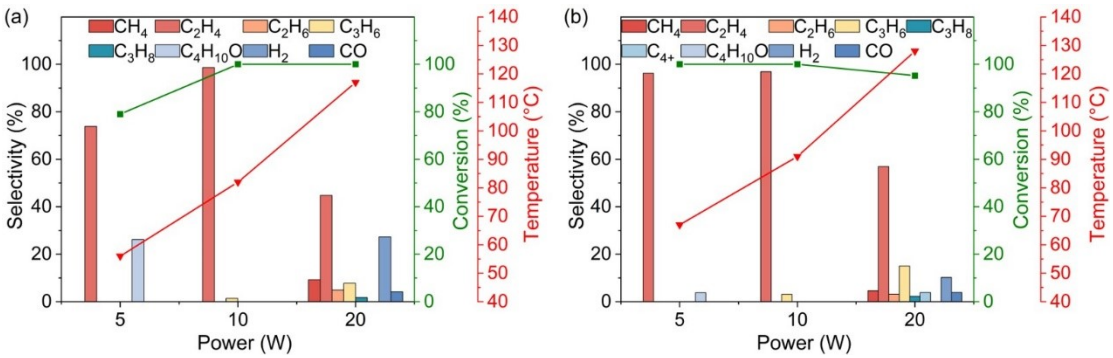


Fig. S3 Product selectivity and ethanol conversion over (a) HBC-2-ZSM-5/MOR (1.5) and (b) HBC-2-ZSM-5/MOR (2) with different microwave input powers.

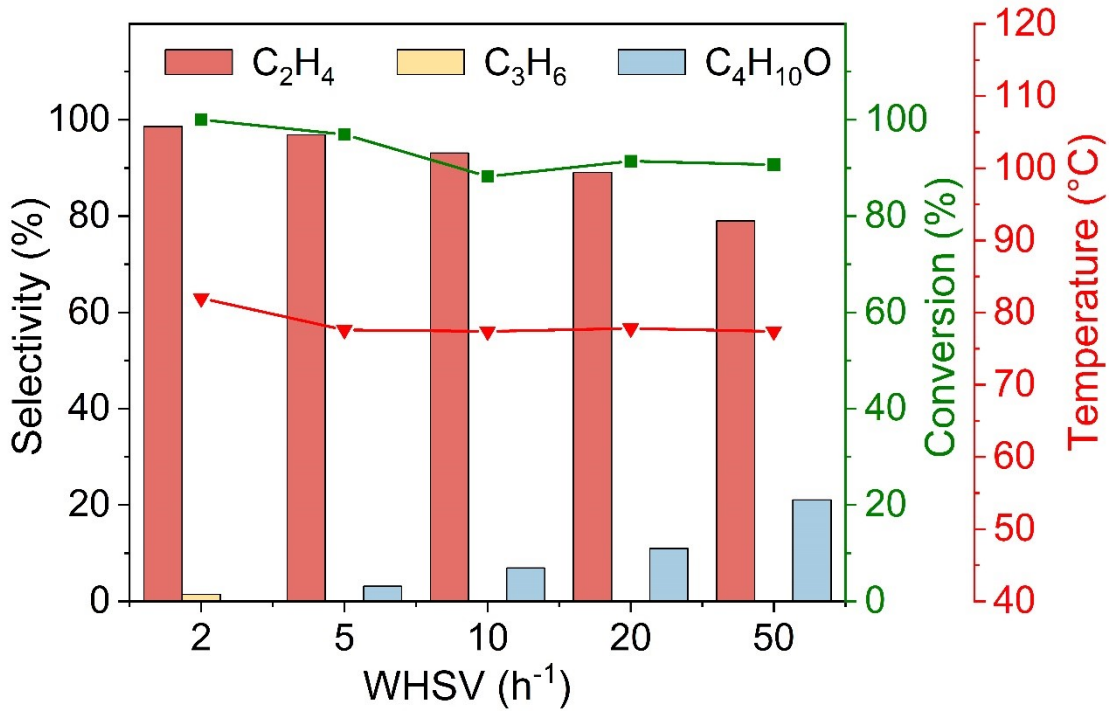


Fig. S4 Product selectivity and ethanol conversion at different ethanol WHSV (h^{-1}) over HBC-2-ZSM-5/MOR (1.5) with 10 W microwave input power.

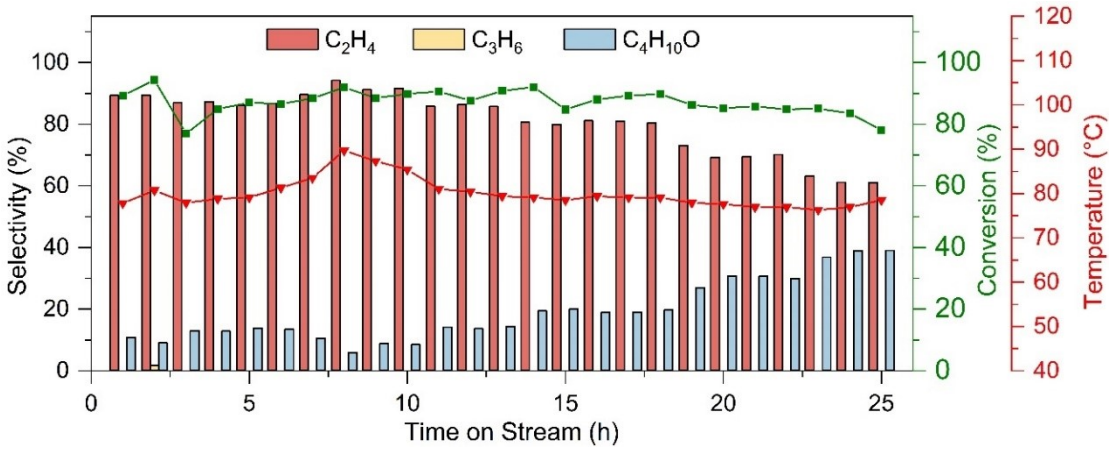


Fig. S5 Product selectivity and ethanol conversion at 20 h^{-1} ethanol WHSV (h^{-1}) over HBC-2-ZSM-5/MOR (1.5) with 10 W microwave input power for 25 h.

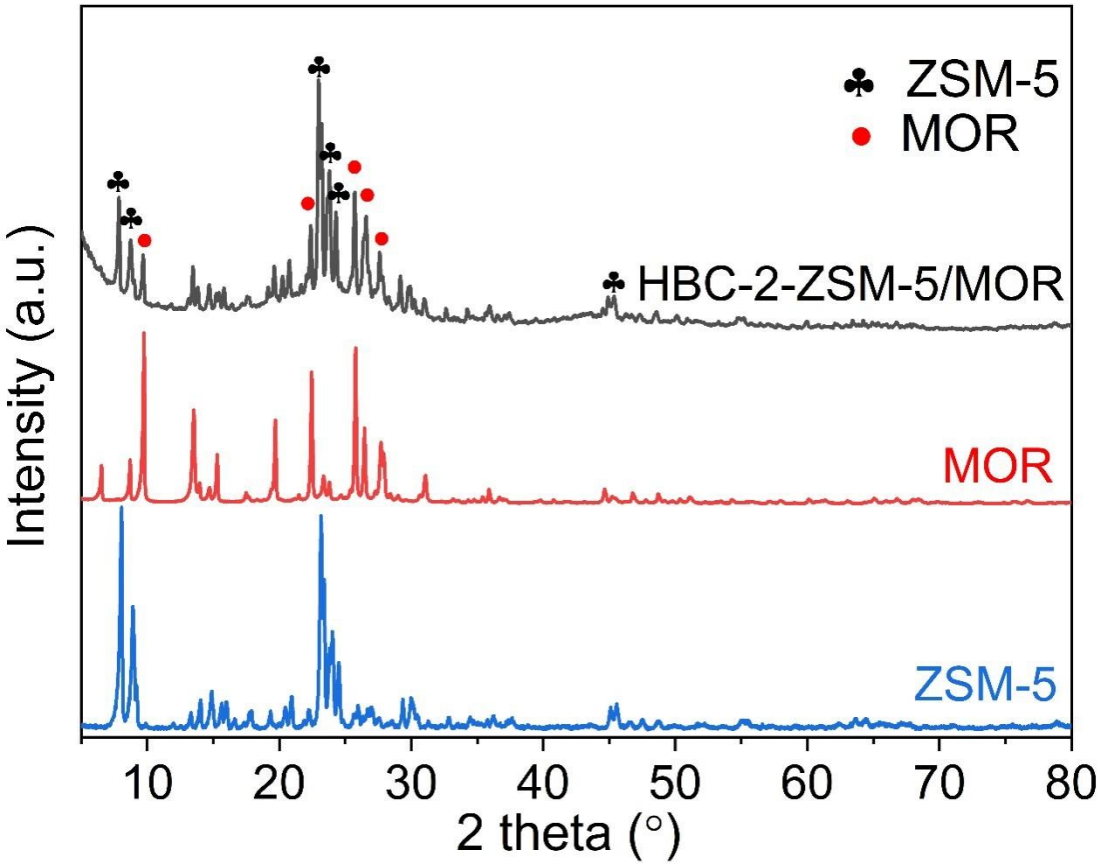


Fig. S6 XRD spectra of HBC-2-ZSM-5/MOR.

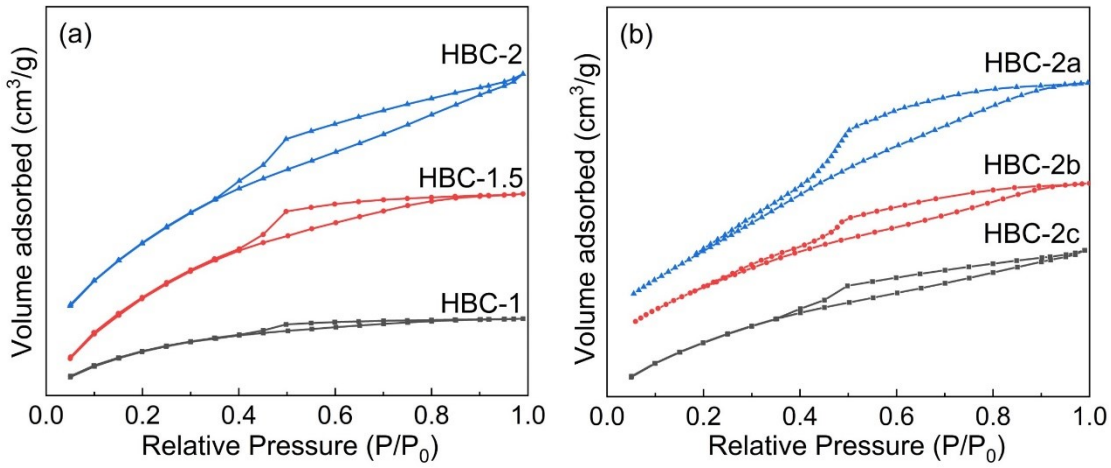


Fig. S7 N_2 adsorption-desorption isotherms of HBC prepared with different conditions. Effect of phosphoric acid dosage (a) and decomposition temperature (b) on the isotherm of N_2 adsorption-desorption.

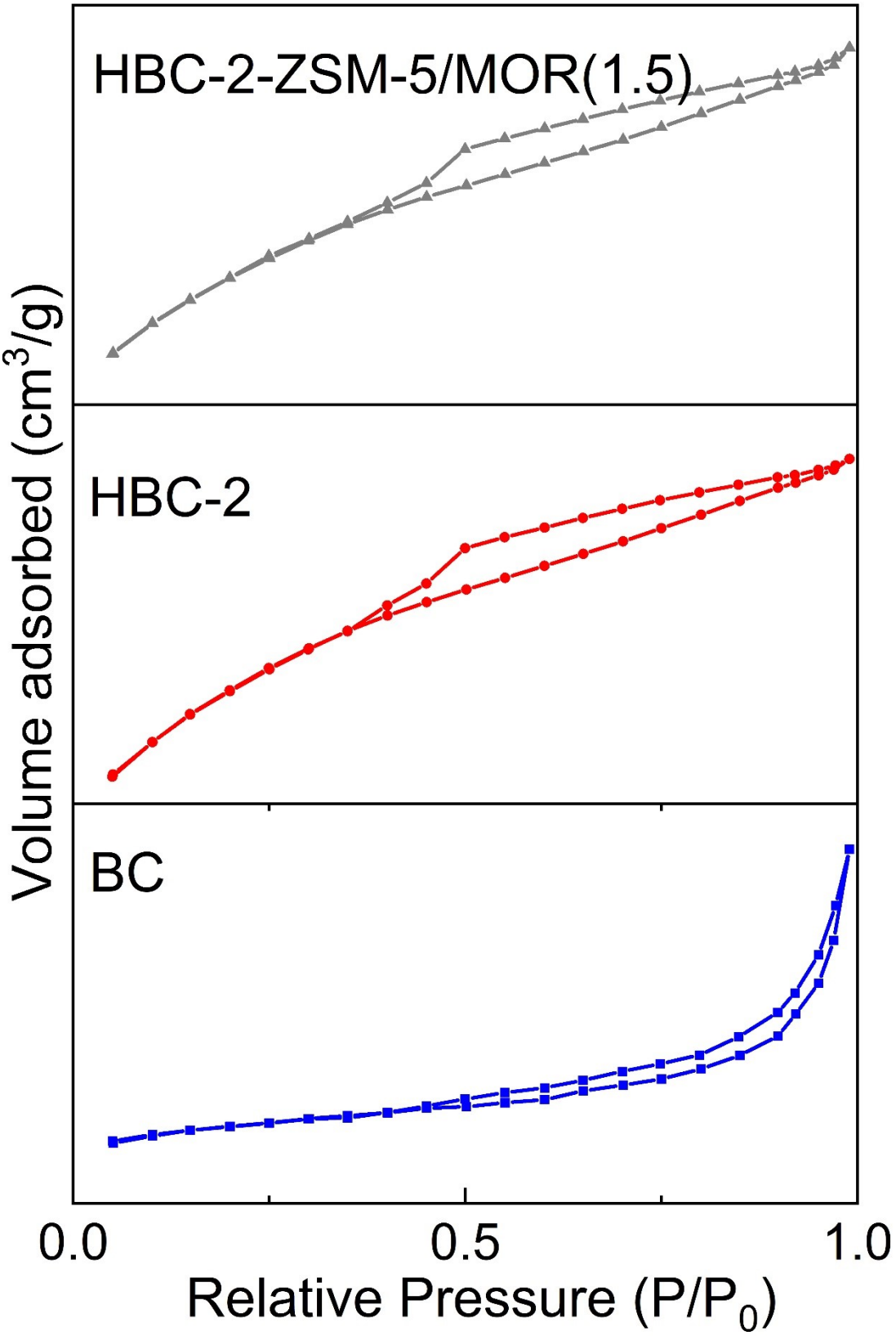


Fig. S8 N_2 adsorption-desorption isotherms of BC, HBC and HBC-2-ZSM-5/MOR (1.5).

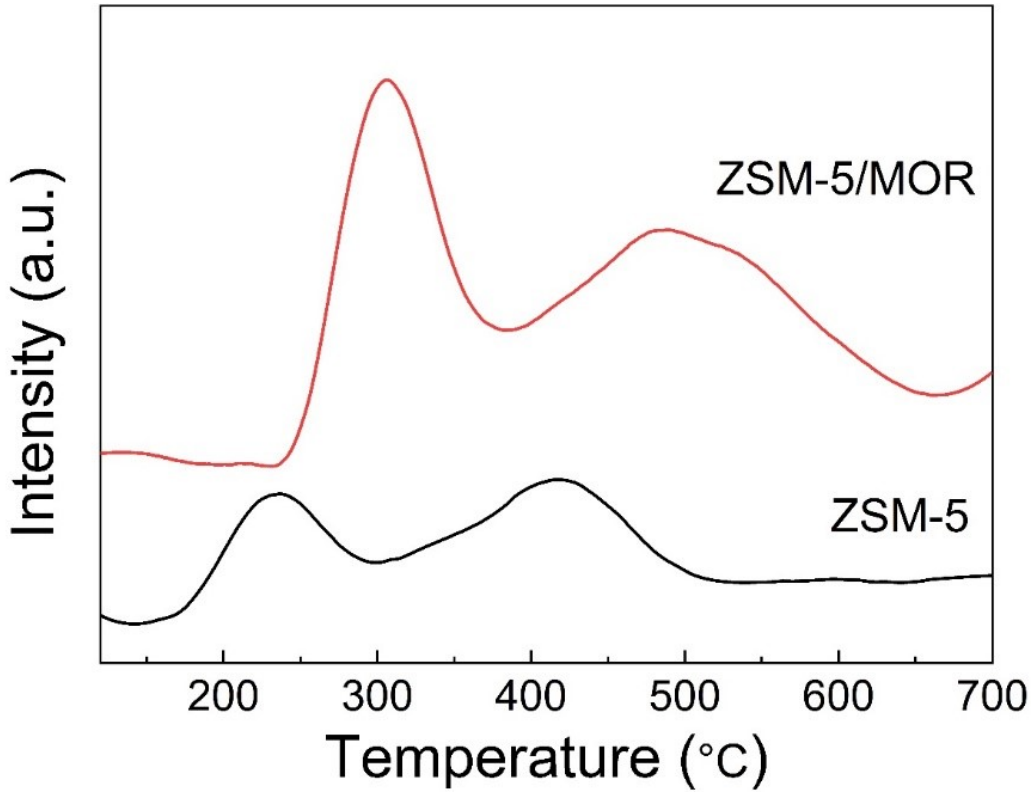


Fig. S9 NH_3 -TPD profiles of ZSM-5 and ZSM-5/MOR.

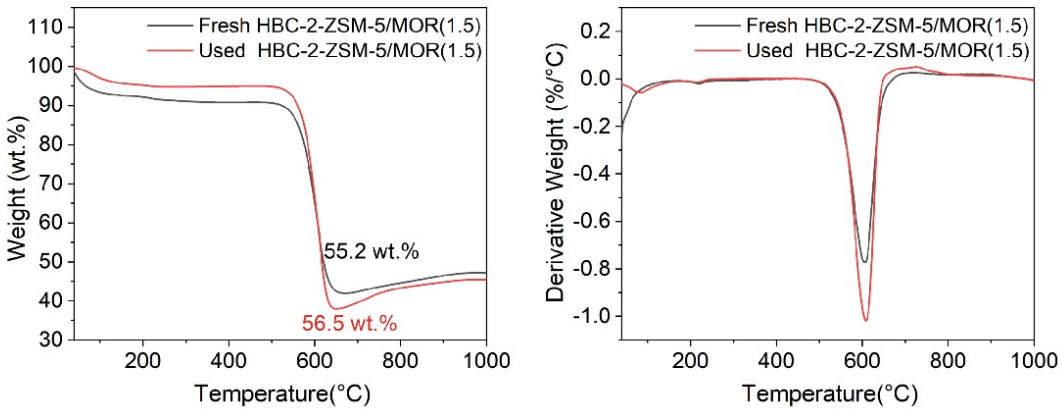
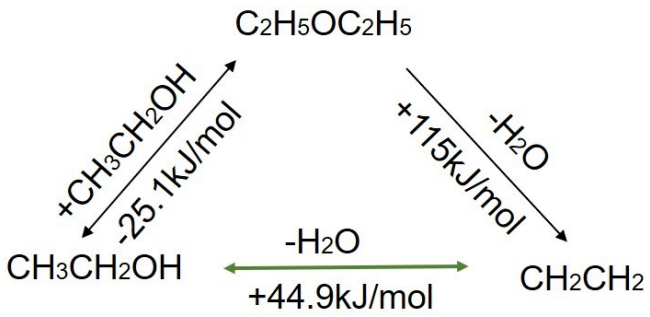


Fig. S10 Thermogravimetric curves of HBC-2-ZSM-5/MOR (1.5) before and after reaction.



$$CH_3CH_2OH \longleftrightarrow CH_3CHO+H_2 = +184kJ/mol$$

$$CH_3CH_2OH \longleftrightarrow CH_4+H_2+CO = +49.0kJ/mol$$

Fig. S11 The conversion pathway and reaction enthalpy of ethanol.

Table S1 Textural properties of ZSM-5/MOR, HBC-2 and HBC-2-ZSM-5/MOR (1.5).

Sample	Specific surface area (m^2/g)	Pore volume (cm^3/g)	Pore size (nm)
ZSM-5/MOR	430	0.27	7.01
HBC-2	1461.83	0.89	8.41
HBC-2-ZSM-5/MOR (1.5)	875.88	0.61	8.07

Table S2 Textural properties of fresh and used HBC-2-ZSM-5/MOR (1.5).

Sample	Specific surface area (m^2/g)	Pore volume (cm^3/g)	Pore size (nm)
Fresh HBC-2-ZSM-5/MOR (1.5)	875.88	0.61	8.07
Used HBC-2-ZSM-5/MOR (1.5)	849.27	0.61	8.07