Supporting Information

Stable co-production of ethylene and aromatics from ethane over Co^{2+}-exchanged HZSM-5 zeolite

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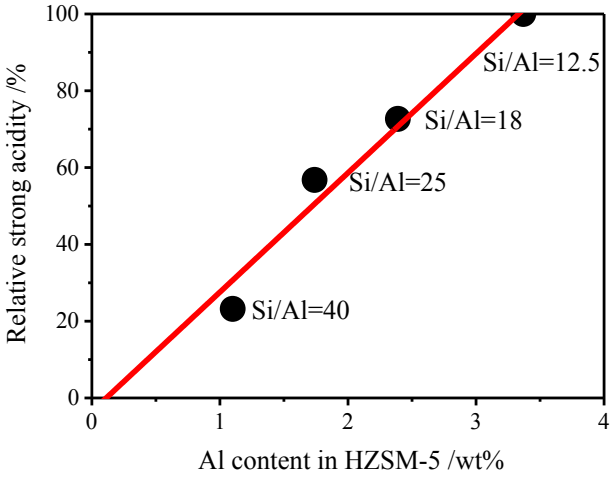

Fig. S1. The relative strong acidity in parent HZSM-5 zeolites as a function of Al content in zeolite based on that in the HZSM-5 (Si/Al = 12.5) supposed to be 100%.

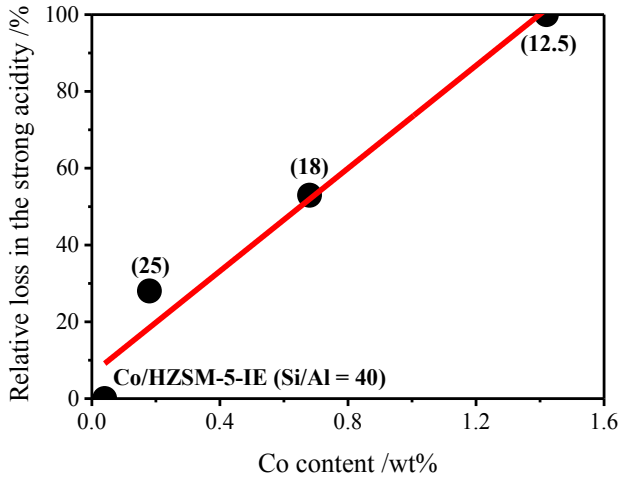

Fig. S2. The relative loss in the strong acidity in the Co/HZSM-5-IE catalysts as a function of Co content based on the loss in the Co/HZSM-5-IE (Si/Al = 12.5) supposed to be 100%.

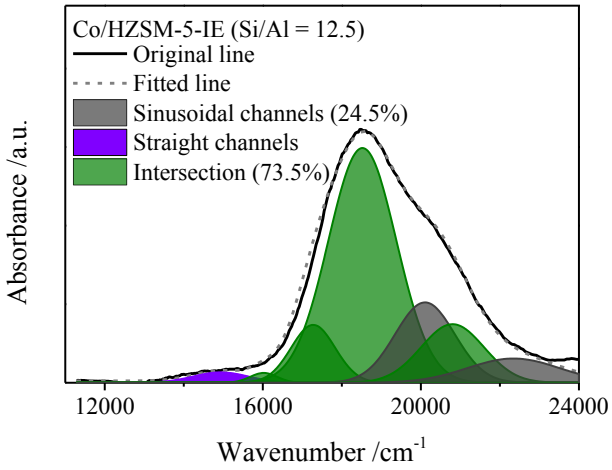

Fig. S3. Deconvolution of UV−vis DR spectrum of Co/HZSM-5-IE (Si/Al = 12.5) catalyst sample.

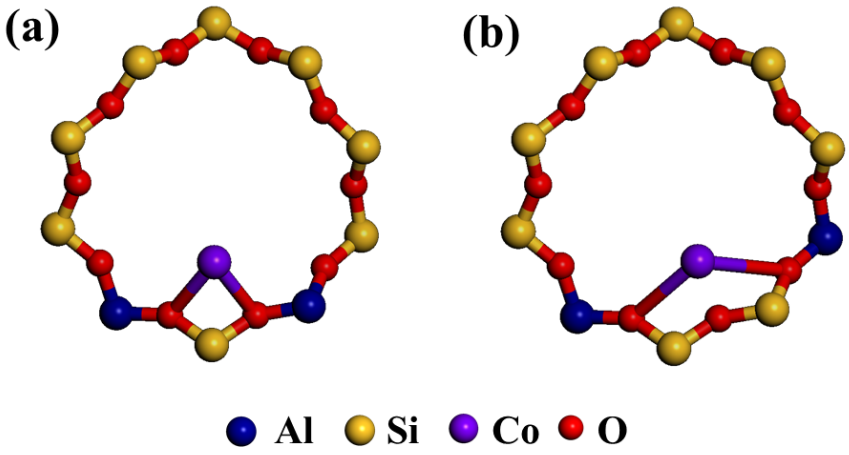

Fig. S4. The schematic location of Co ions in the ion-exchanged Co/HZSM-5 catalyst: (a) possibly existed in a zeolite with a very low Si/Al ratio; (b) commonly existed, especially, in a zeolite with a high Si/Al ratio.

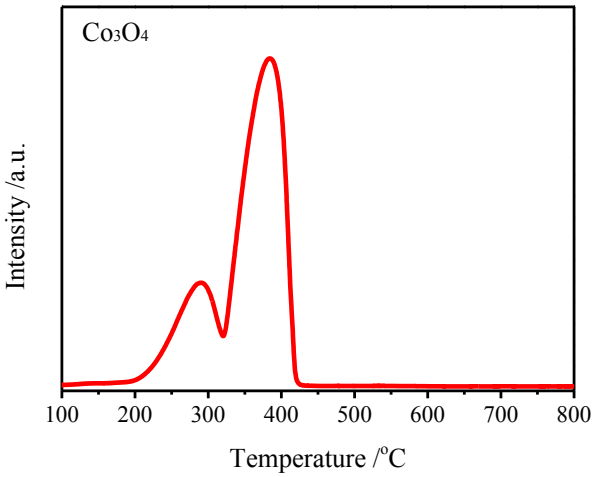

Fig. S5. H_2-TPR profile of a synthesized Co_3O_4 compound.

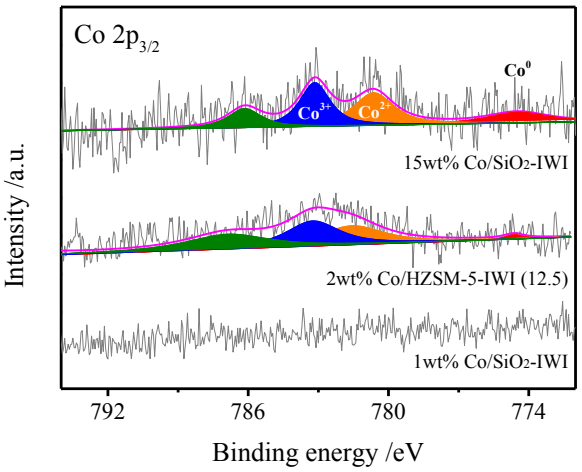

Fig. S6. XPS spectra of 1 wt%, 15 wt% Co/SiO_2-IWI and 2 wt% Co/HZSM-5-IWI (Si/Al = 12.5) catalysts reduced by H_2 at 600 °C for 30 min.

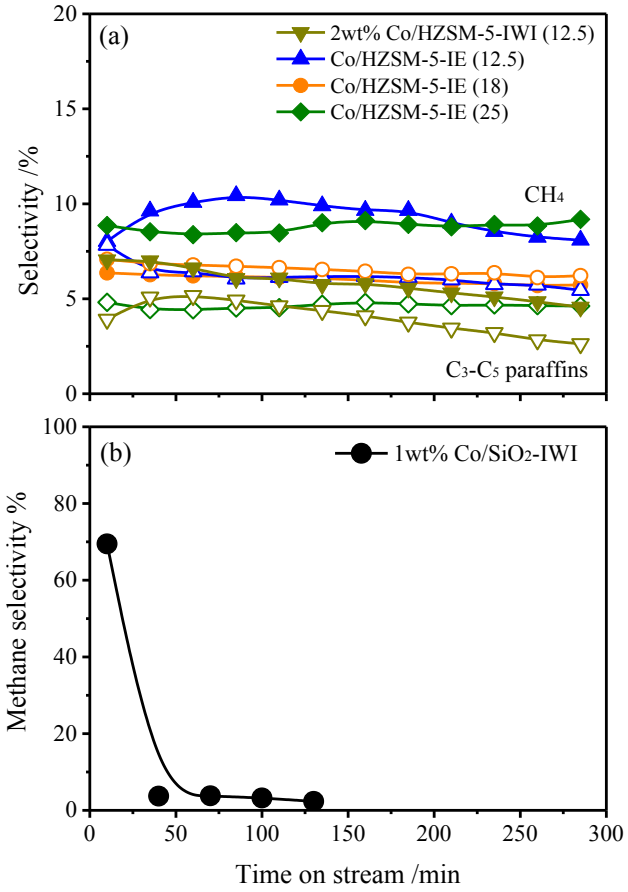

Fig. S7. The selectivities to paraffins for Co-based catalysts. Reaction conditions: 0.3 g of catalysts, 90%C_2H_6/N_2, 15 mL/min, 600 ^oC, pressure at 0.1 MPa.

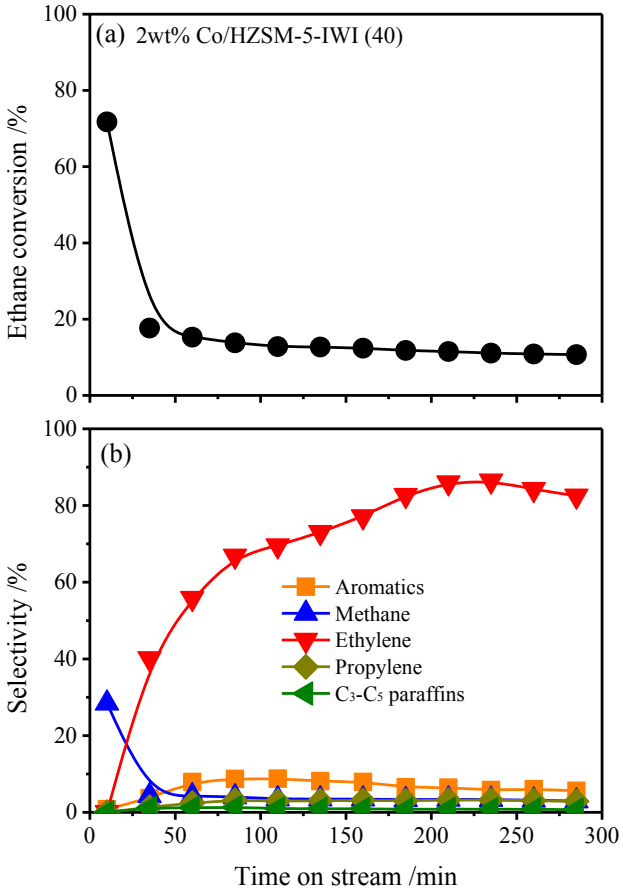

Fig. S8. Time-dependence of C_2H_6 conversion and the selectivity to various hydrocarbons for the 2 wt% Co/HZSM-5-IWI (40) catalysts at 600 °C, 0.1 MPa, 3000 mL/g/h and 90%C_2H_6/10%N_2.

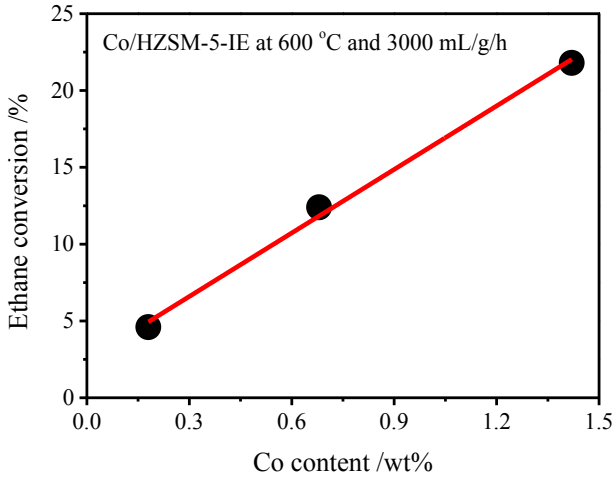

Fig. S9. The plotting of ethane conversion as a function of Co content in the Co-exchanged HZSM-5 catalyst. Reaction condition: 600 °C, 0.1 MPa, 3000 mL/g/h and 90%C_2H_6/10%N_2.

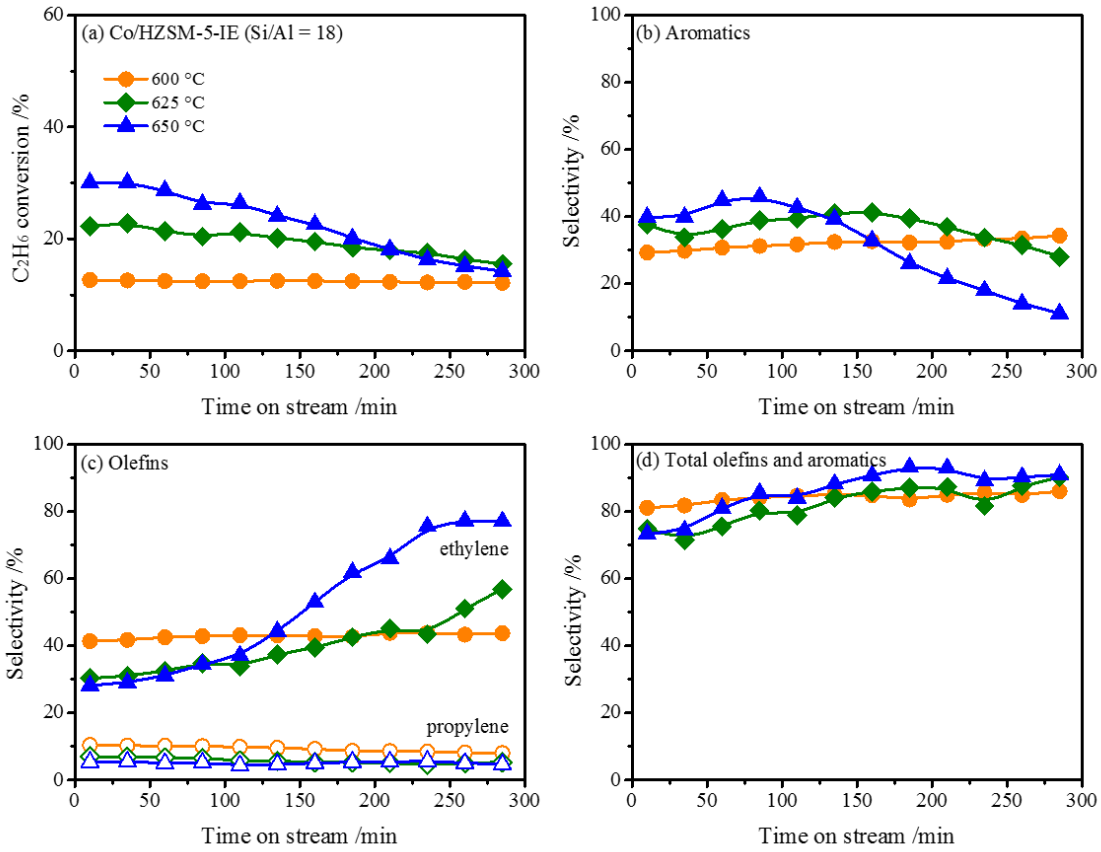

Fig. S10. The C_2H_6 conversion and selectivity to olefins and aromatics over Co/HZSM-5-IE (Si/Al = 18) catalyst at various reaction temperatures (600-650 °C) and 3000 mL/g/h.

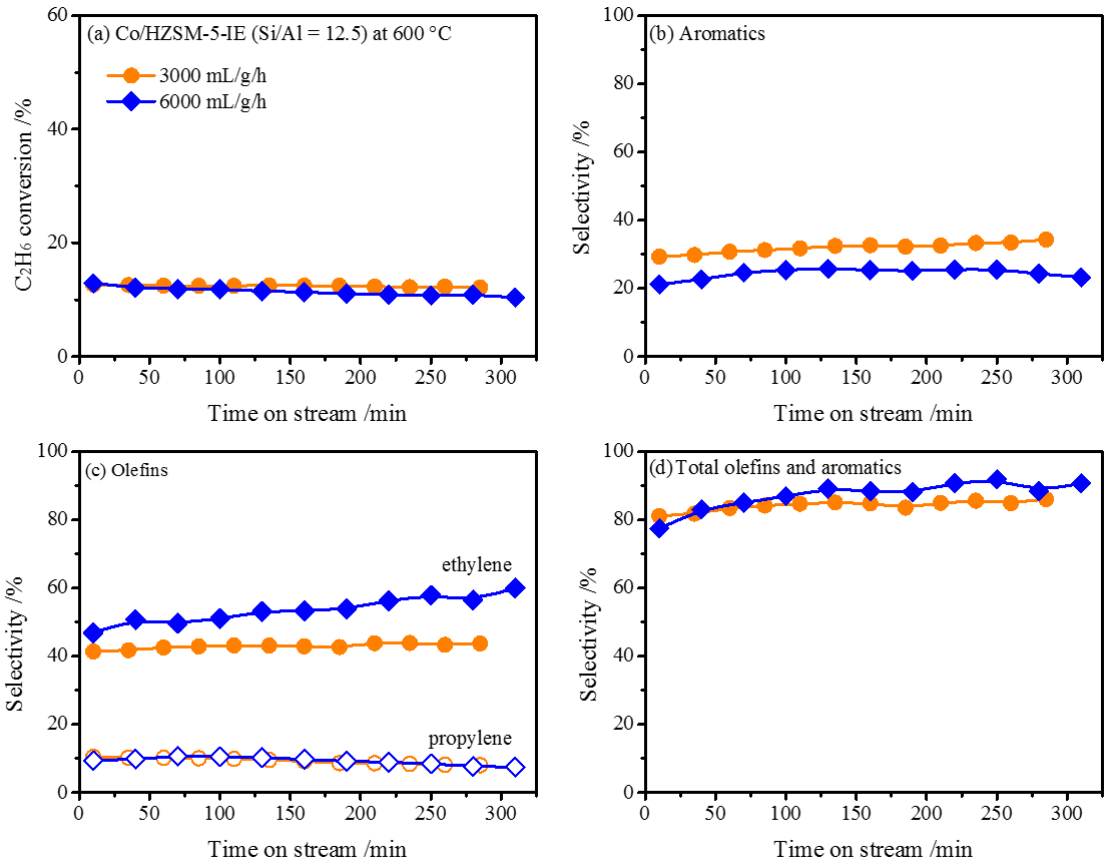

Fig. S11. The C_2H_6 conversion and selectivity to olefins and aromatics over Co/HZSM-5-IE (Si/Al = 18) catalyst at 600 °C and two space velocities of 3000 and 6000 mL/g/h.

Table S1. Ethane conversion and products selectivities over Co/HZSM-5 catalysts

Catalyst	Ethane conv. [a] /%	Selectivity [a] /%												Olefins /%	Aromatics /%
		CH_4	C_2H_4	C_3H_6	C_3H_8	C_4-C_6	Benz	Toul	Xyl	TMB	Naph	Me-Naph	Coke [b]		
Co/ZSM-5-IE (12.5)	21.5	9.3	**40.1**	**4.4**	3.1	2.0	**12.8**	**13.9**	**3.0**	**1.3**	**3.5**	**3.6**	3.1	**44.5**	**38.1**
Co/ZSM-5-IE (18)	12.4	6.0	**42.9**	**8.6**	3.1	2.9	**14.3**	**11.3**	**2.8**	**0.7**	**1.5**	**1.3**	4.6	**51.5**	**31.9**
Co/ZSM-5-IE (25)	4.6	8.7	**54.0**	**11.6**	2.3	2.4	**4.2**	**3.2**	**0.6**	**0.2**	**3.1**	**0**	9.7	**65.6**	**11.3**

[a] *The feed is 10%N_2/90%C_2H_6 and the reaction lasted for 300 min at 600 °C and 0.1 MPa.*

[b] *The selectivity to coke was obtained by subtraction method and carbon balance was confirmed to be 95-105% according to the coke amount in the spent samples.*