Supporting Information

1. Catalyst evaluation

Using N_2 as an internal standard for analyzing products, the products were analyzed on-line with a gas chromatograph (GC). The gaseous phase products monitored by online analysis using TDX-01 packed column equipped with a TCD detector and a PLOT-Q pillared column connected to an FID detector produced by Shimadzu. Aromatic hydrocarbons were analyzed with an FID detector on a DB-WAX column produced by Agilent[1].

2. Figure and table(s)

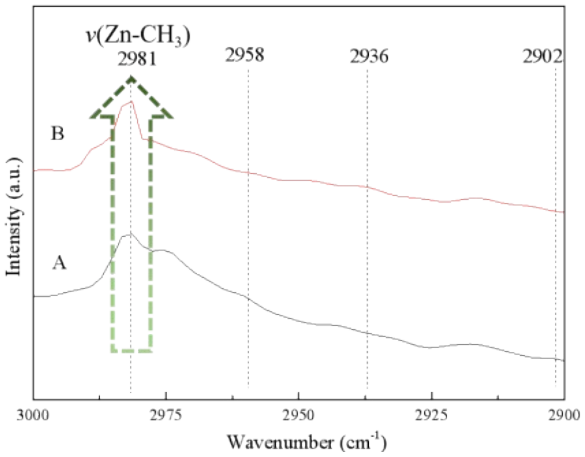

Fig. S1. In-situ IR spectra of the Zn/ZSM-5 catalyst recorded at 550℃. In-situ IR spectra scanning range 3000 to 2900 cm^{-1}, A: mixed gas (30 mL/min, C_3H_8:N_2 = 3:2, mole ratio) was introduced into an in-situ cell (550 °C and atmospheric pressure) containing fresh catalyst for 30 min and measured for IR spectra; B: based on the experiment in a, CH_4 (30 mL/min) was fed into the in-situ cell (550 °C and atmospheric pressure) containing above catalyst for 30 min, and then IR spectra were recorded.

Table S1. Assignments of In-situ infrared bands

Band(cm^{-1})	Assignment
2902	stretching vibration of CH group
2936	stretching vibration of CH_2 group
2958	stretching vibration of CH_3 group
2981	Zn methyl species

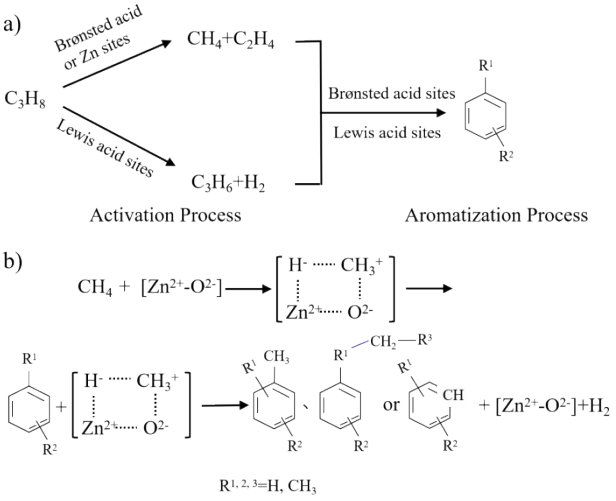

Fig. S2. Mechanism of methane co-aromatization with propane[2].

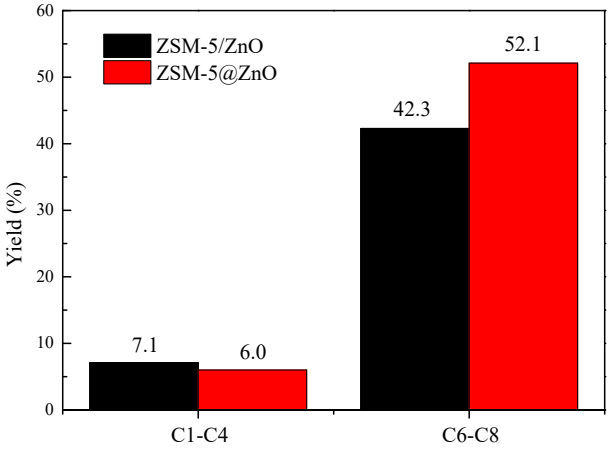

Fig. S3. The product yield in propane aromatization at 5 h over the different catalysts.

Reference

[1] L. Zheng, D. Xuan, J. Guo, H. Lou, X. Zheng, Non-Oxidative Aromatization of CH_4-C_3H_8 over La-Promoted Zn/HZSM-5 Catalysts, Journal of Natural Gas Chemistry 15(1) (2006) 52-57.

[2] G. Xu, X. Zhu, A core-shell structured Zn/SiO_2@ZSM-5 catalyst: Preparation and enhanced catalytic properties in methane co-aromatization with propane, Applied Catalysis B: Environmental 293 (2021) 120241.