Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

Supplementary Information

For

In situ encapsulation of platinum clusters within H-ZSM-5 zeolite for highly stable benzene methylation catalysis

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Table S1 ICP analysis of ZSM-5 and Pt modified ZSM-5 catalysts.

Samples	Pt content (wt %)	Composition		
		Si (mg/Kg)	Al (mg/Kg)	Si/Al
ZSM-5	/	1466512	918	1533
Pt/ZSM-5	0.105	1492595	833	1719
Pt@ZSM-5	0.091	1297491	753	1652

Table S2 Gas products distributions over the first regenerated ZSM-5 catalysts.

Sample	Gaseous components (mole %)									Total olefins
	C_1	C_2	$C_2^=$	C_3	$C_3^=$	C_4	$C_4^=$	C_5	$C_5^=$	(%)
Pt/ZSM-5-Regen	36.79	16.24	8.32	9.40	12.93	2.52	2.08	1.33	0.34	23.67
Pt@ZSM-5-Regen	37.25	34.25	2.54	22.21	2.29	0.51	0.24	0.36	0.03	5.52

Reaction conditions: T = 400 °C, P = 0.1 MPa, WHSV = 2 h^{-1}, feed: $n_{benzen}/n_{methanol}$ = 1:1.

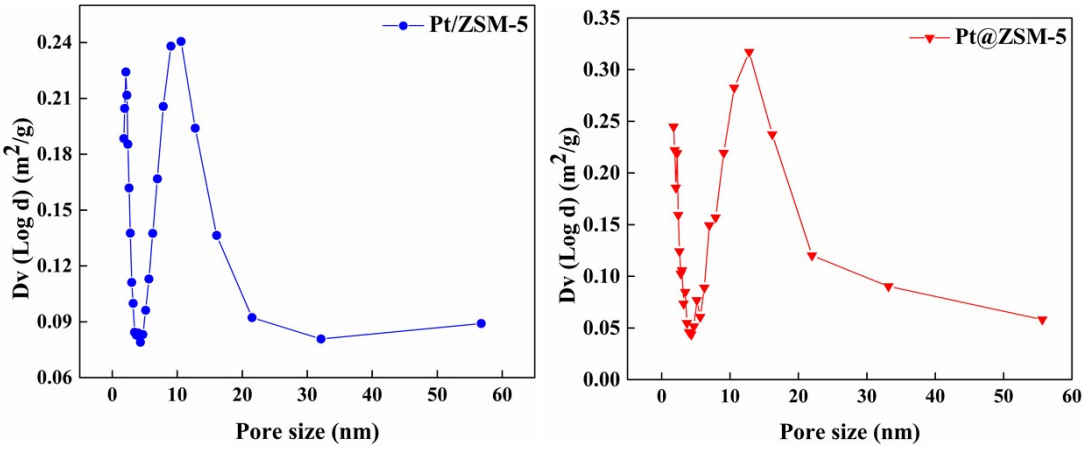

Fig. S1. The pore-size distribution of Pt/ZSM-5 and Pt@ZSM-5 catalysts deduced from the adsorption branch of the isotherm.

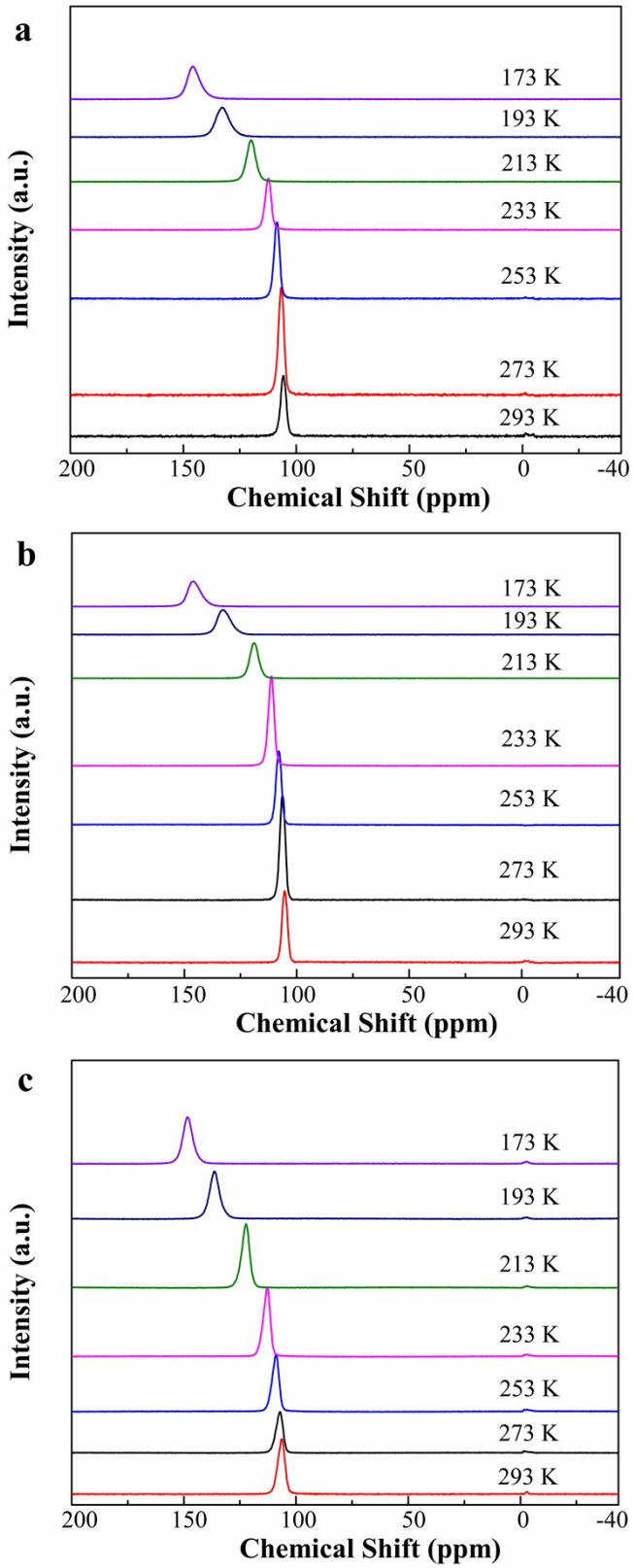

Fig. S2. Hyperpolarized ^{129}Xe NMR spectra of Xe adsorbed in (a) ZSM-5, (b) Pt/ZSM-5, and (c) Pt@ZSM-5. The temperature is varied from 293 to 173 K.

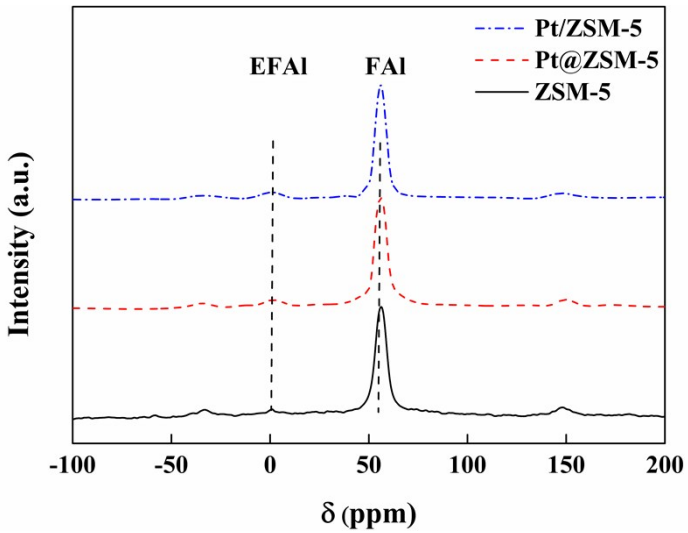

Fig. S3. Solid-state ^{27}Al MAS NMR spectra of the ZSM-5 and Pt-modified ZSM-5 catalysts.

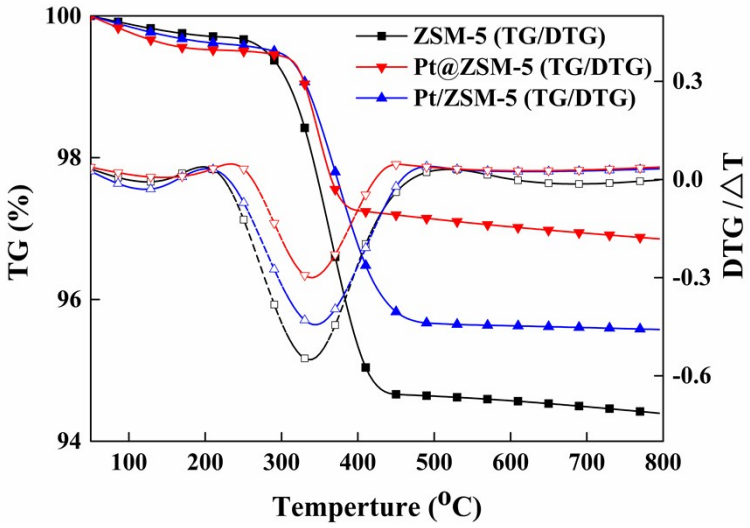

Fig. S4. Thermogravimetric measurements (TG-DTA) of the coked catalysts after the successive reaction time: ZSM-5, 96 h; Pt/ZSM-5, 238 h; Pt@ZSM-5, 305 h.

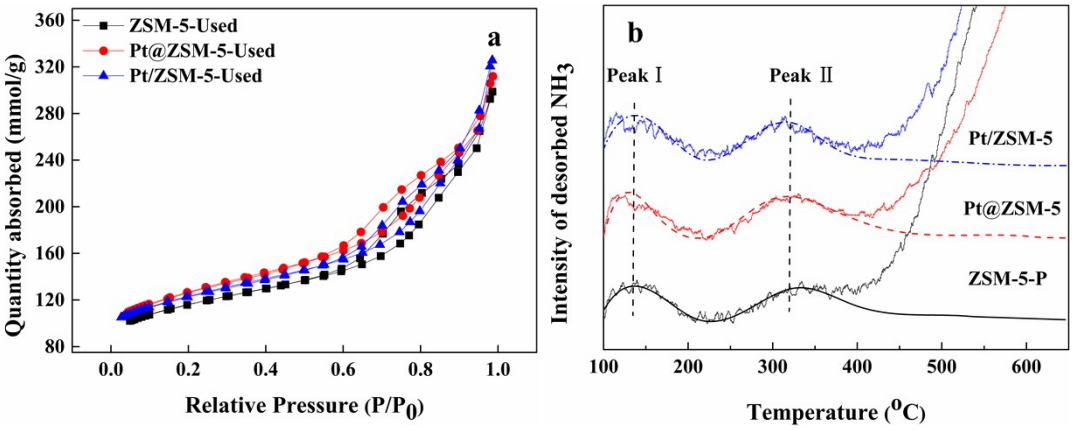

Fig. S5. Nitrogen adsorption–desorption isotherms (a) and NH_3-TPD profiles (b) of the used ZSM-5 catalyst.

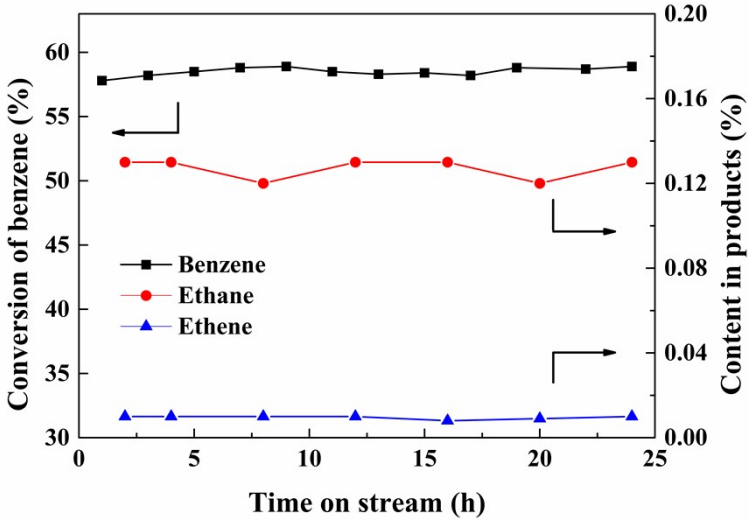

Fig. S6. Catalytic performance of the regenerated Pt@ZSM-5 catalyst on benzene alkylation with methanol: conversion of benzene and content of ethane and ethylene in products.