Scaled-up laboratory test of shaped nano H-ZSM-5 based catalysts for methanol-to-hydrocarbon study

Bonan Liu[1*], Xiaochun Zhu[1], Jun Zhao[2], Duanda Wang[2], and Wangjing Ma[2*]

[1] State Key Laboratory of Heavy Oil Processing, China University of Petroleum (Beijing), 18 Fuxue Road, Beijing,102249, China; liubonan@cup.edu.cn

[2] Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, 29 Zhongguancun East Road, Haidian District, Beijing, 100190, China; wjma@ipc.ac.cn

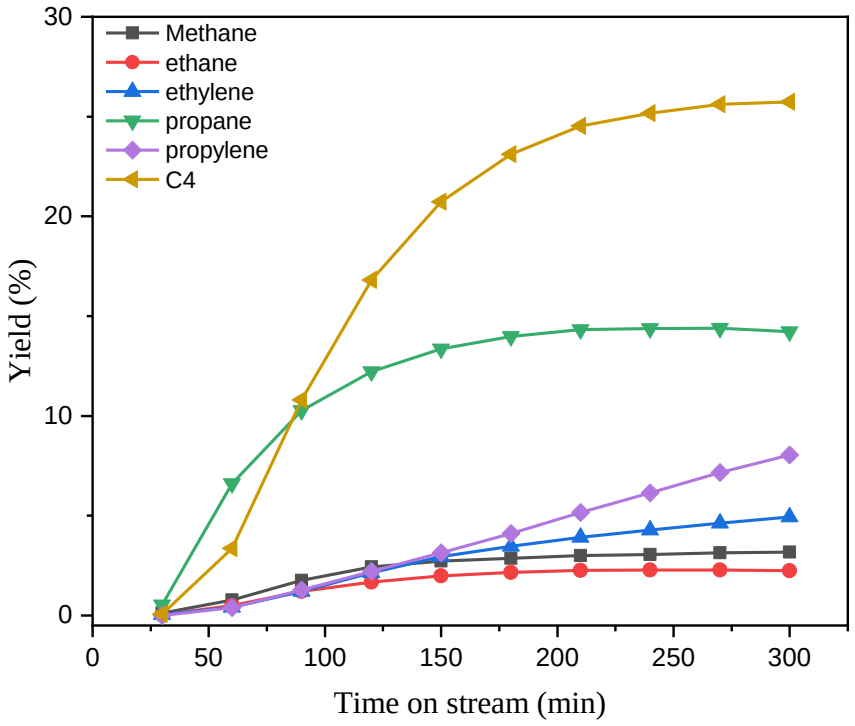

Figure S1. 5h C_1-C_4 product yields, Al-H-ZSM-5 20

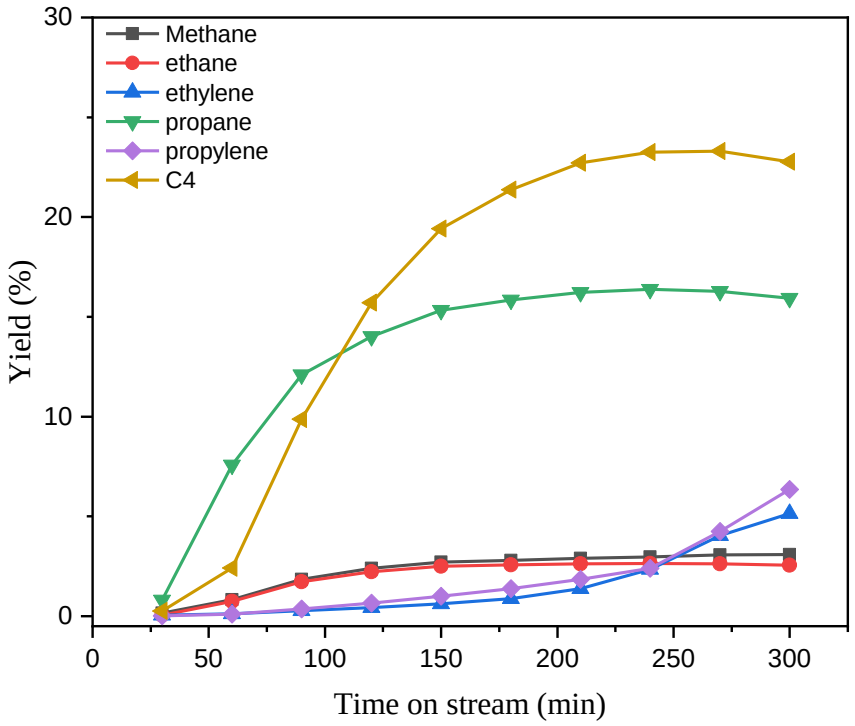

Figure S2. 5h C_1-C_4 product yields, H-ZSM-5 20

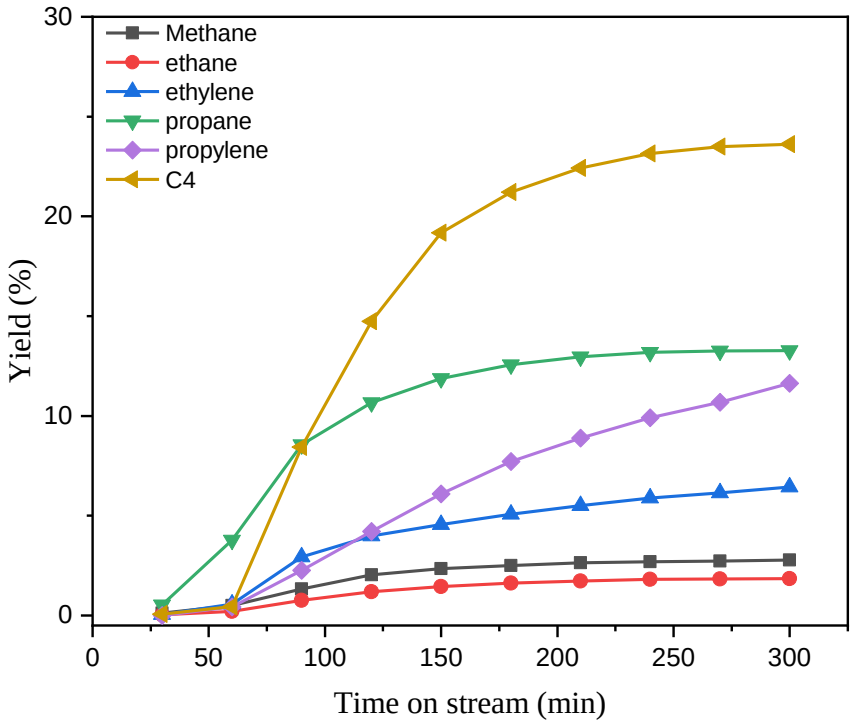

Figure S3. 5h C_1-C_4 product yields, Al-H-ZSM-5 60

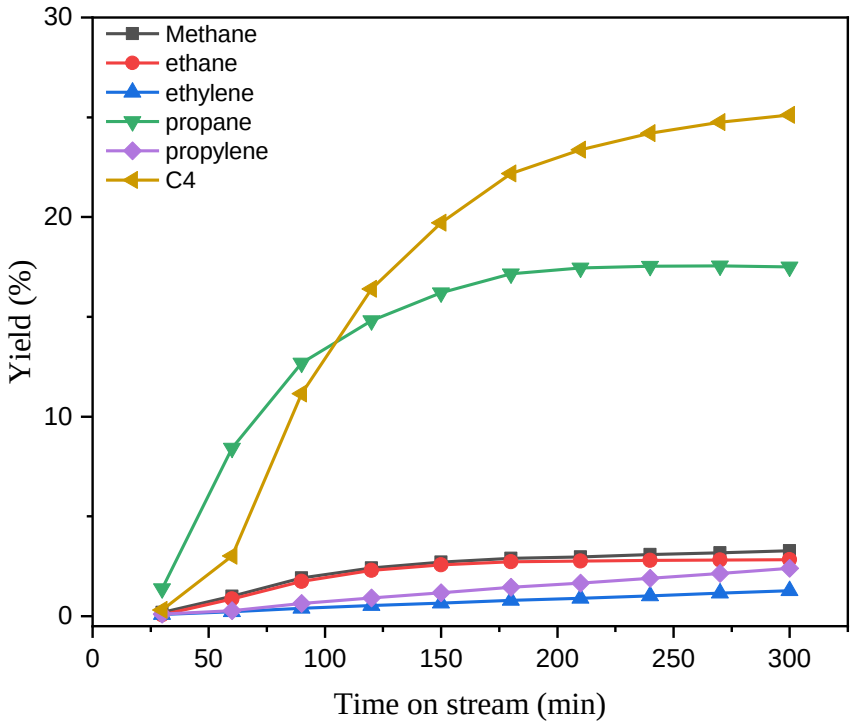

Figure S4. 5h C_1-C_4 product yields, H-ZSM-5 60

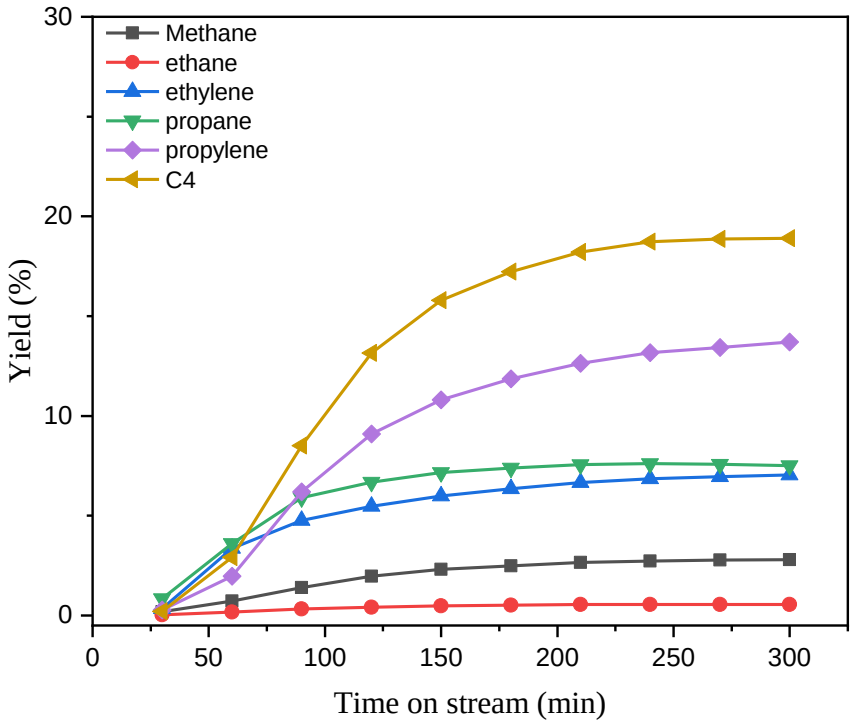

Figure S5. 5h C_1-C_4 product yields, Al-H-ZSM-5 120

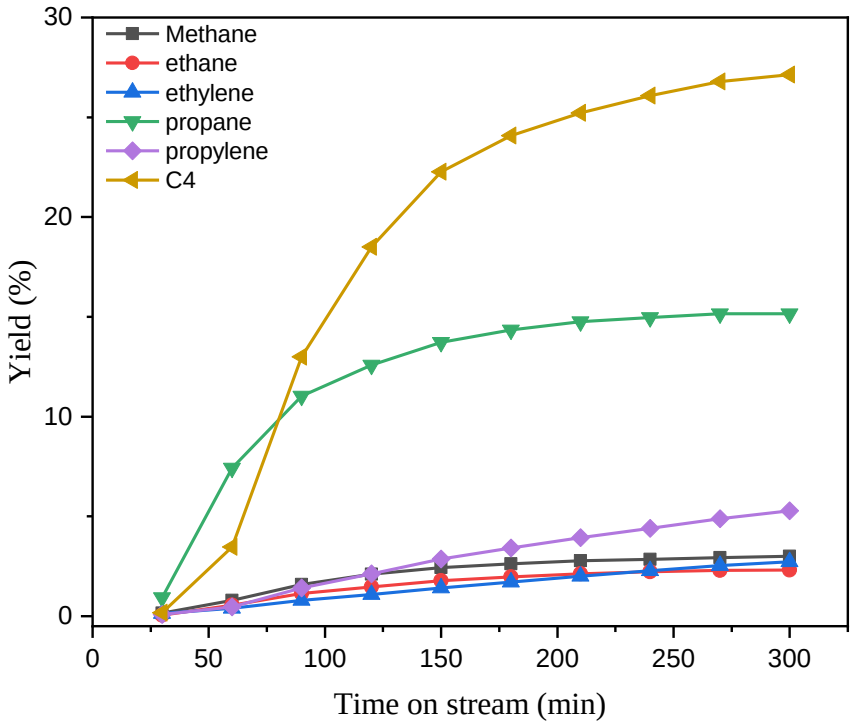

Figure S6. 5h C_1-C_4 product yields, H-ZSM-5 120

Table.S1 BET surface area of the prepared samples

Pseudo-boehmite uncalcined 205.34 m^2/g, resultant after calcination 238.04 m^2/g

Samples	Surface area m^2/g
H-ZSM-5 20 powder	399.89
Post reaction H-ZSM-5 20 powder	202.85
Al-H-ZSM-5 20 extrudate	364.55
Al-H-ZSM-5 20 powder	361.88
Post reaction Al-H-ZSM-5 20 extrudate	248.12
H-ZSM-5 60 powder	402.07
Post reaction H-ZSM-5 60 powder	217.7
Al-H-ZSM-5 60 extrudate	366.38
Al-H-ZSM-5 60 powder	360.75
Post reaction Al-H-ZSM-5 60 extrudate	284.42
H-ZSM-5 120 powder	403.31
Post reaction H-ZSM-5 120 powder	234.38
Al-H-ZSM-5 120 extrudate	356.83
Al-H-ZSM-5 120 powder	403.31
Post reaction Al-H-ZSM-5 120 extrudate	292.47

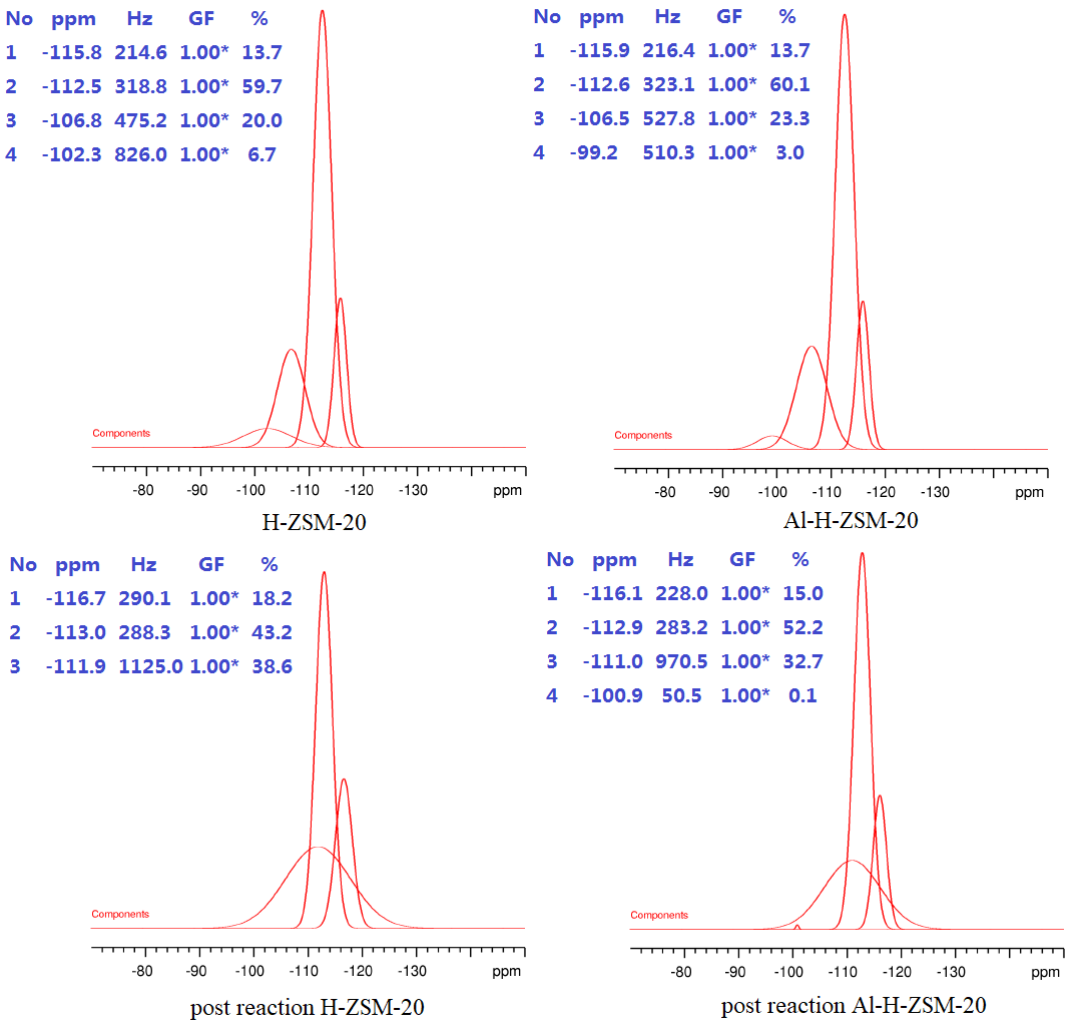

Figure S7. de-convoluted ^{29}Si NMR spectra of samples based on nano H- ZSM-5 (Si/Al=20)

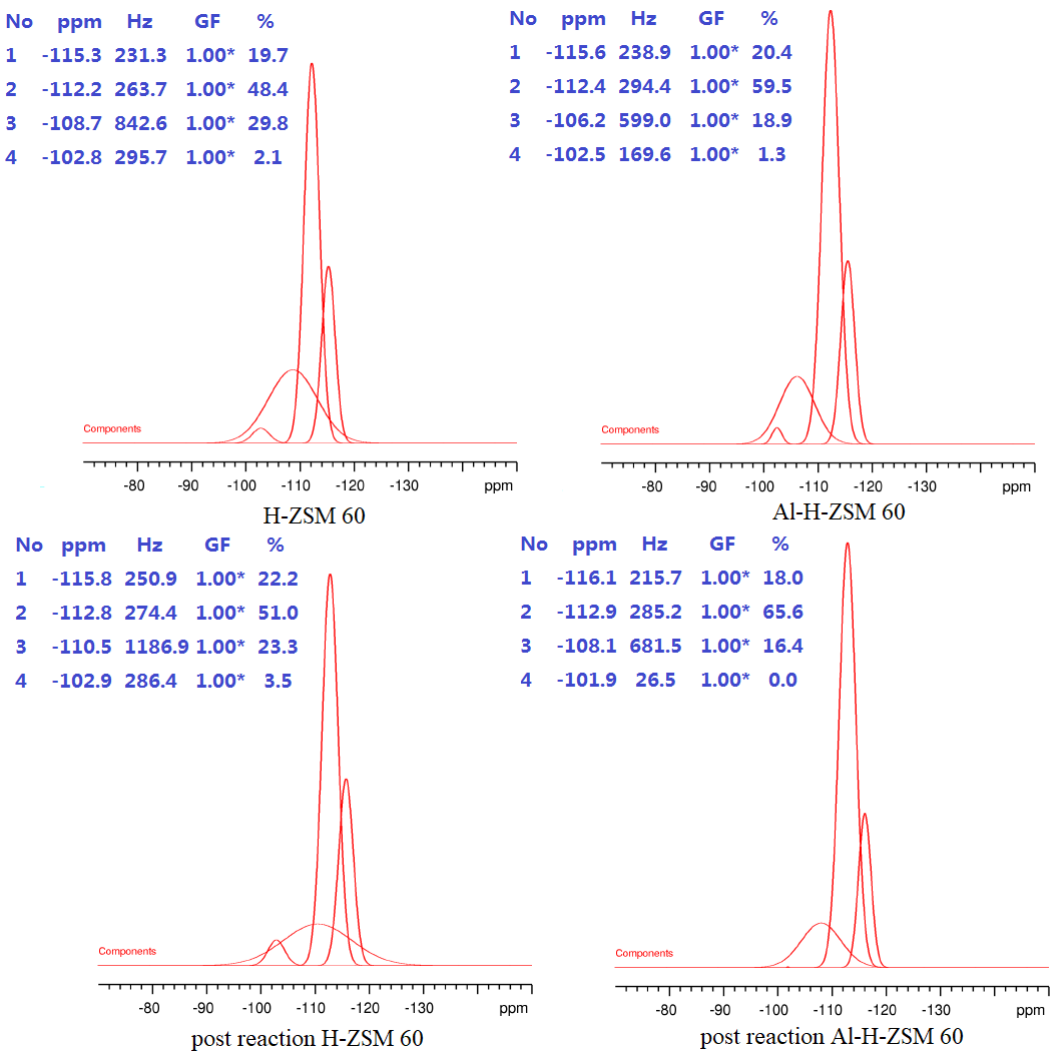

Figure S8. de-convoluted ^{29}Si NMR spectra of samples based on nano H- ZSM-5 (Si/Al=60)

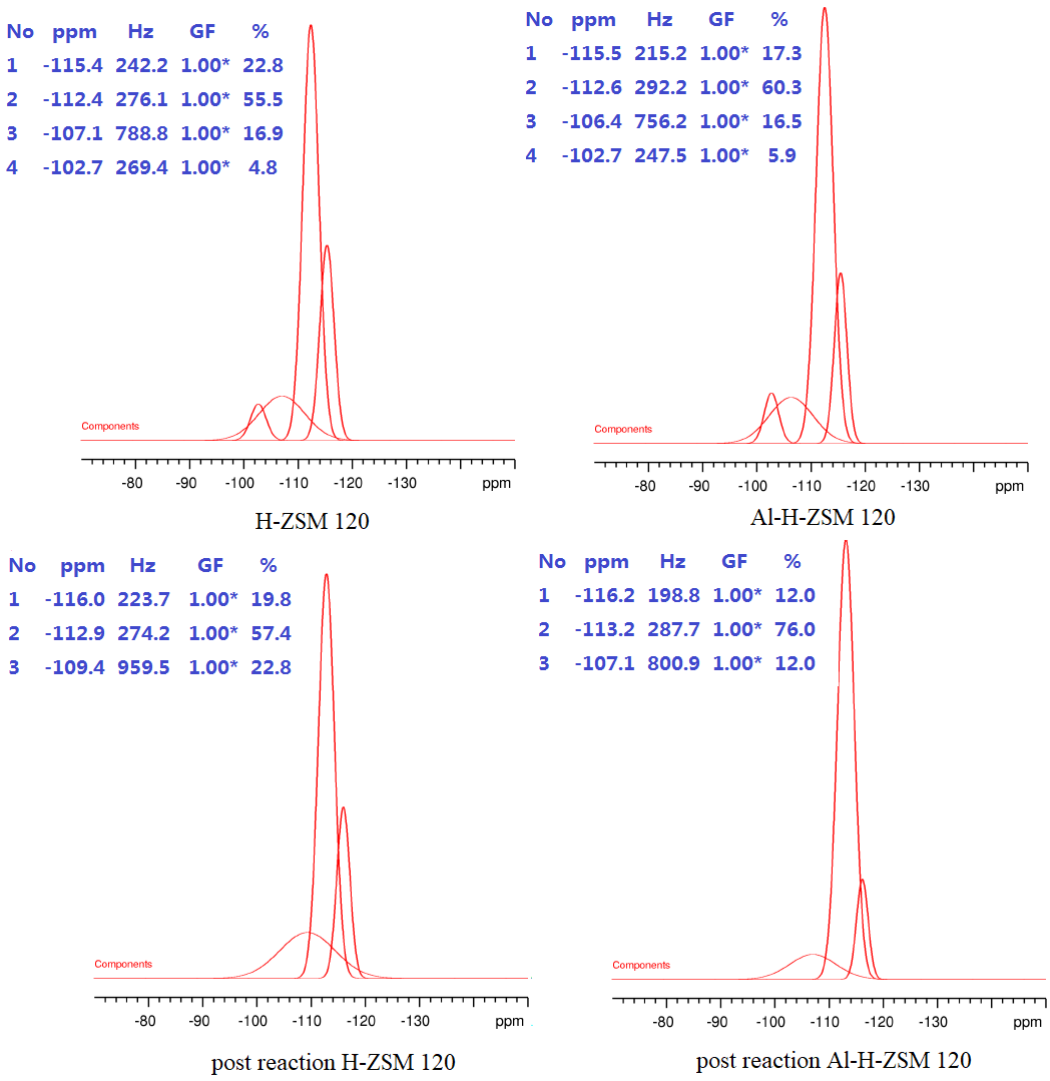

Figure S9. de-convoluted ^{29}Si NMR spectra of samples based on nano H- ZSM-5 (Si/Al=120)

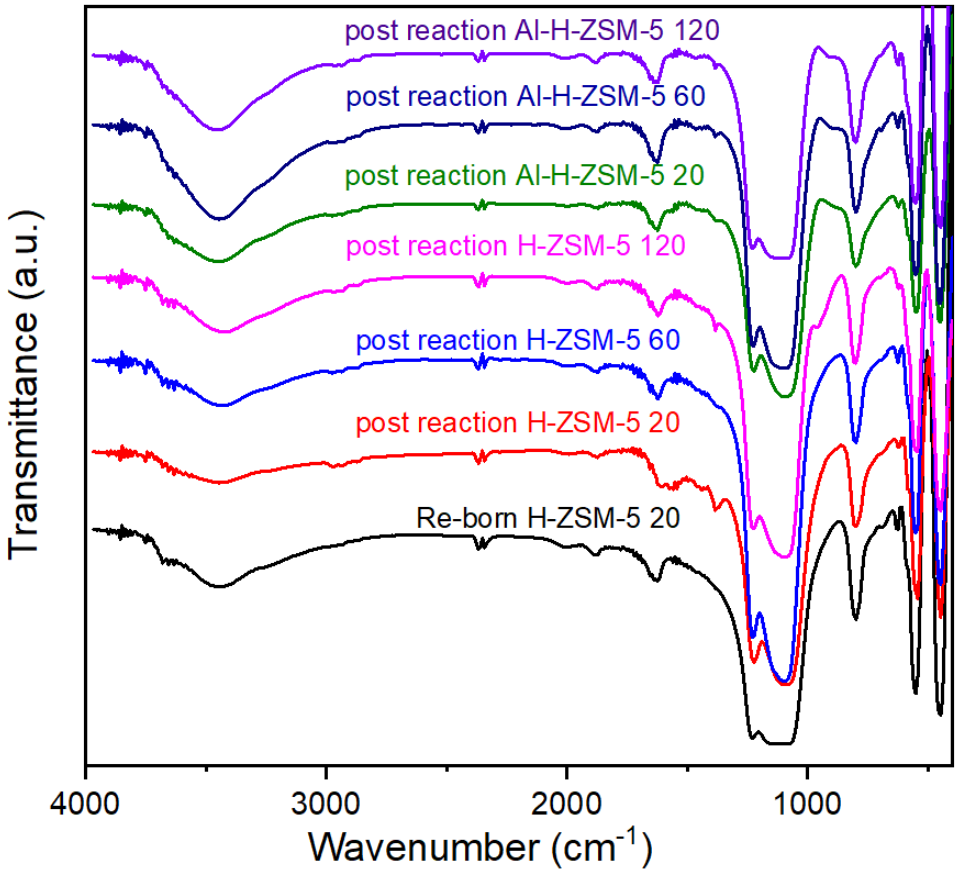

Figure S10. FT-IR spectra (3500-400 cm^{-1}) of coked Al incorporated samples and the original nano H-ZSM-5 zeolites

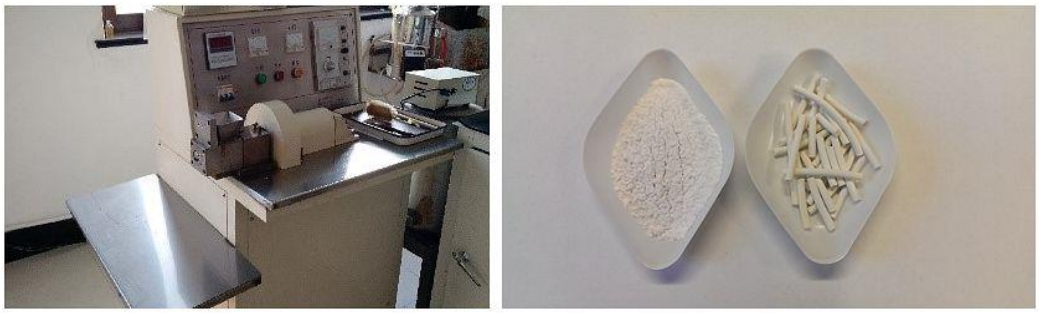

Figure S11. Mini inudustrial screw extruder for catalyst shaping; 1g of parent zeolite (H-ZSM-5 60), and 5g of its extrudate (Al-H-ZSM-5 60)

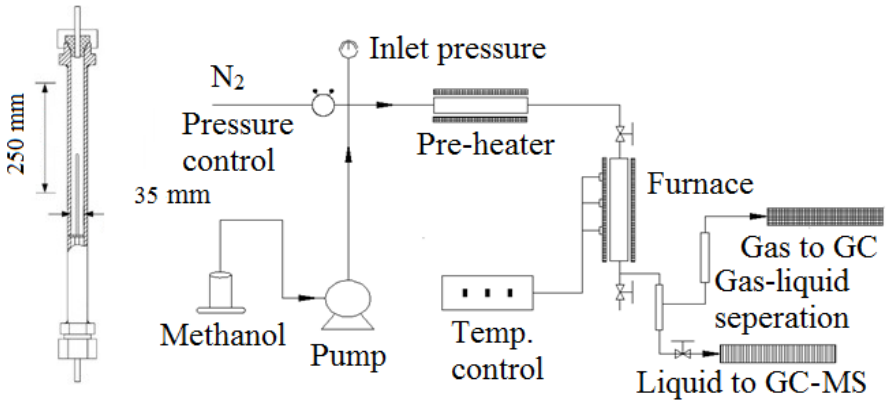

Figure S12. Reactor structure with parameters (inner diameter = 23.74 mm, designed available catalyst bed height / inner diameter = 5:1, calculated available catalyst bed height = 118.7mm) and product analysis system