

Supporting Information for

Mechanistic insight to effect of acidity of Ga/HZSM-5 on its activity for
propane aromatization

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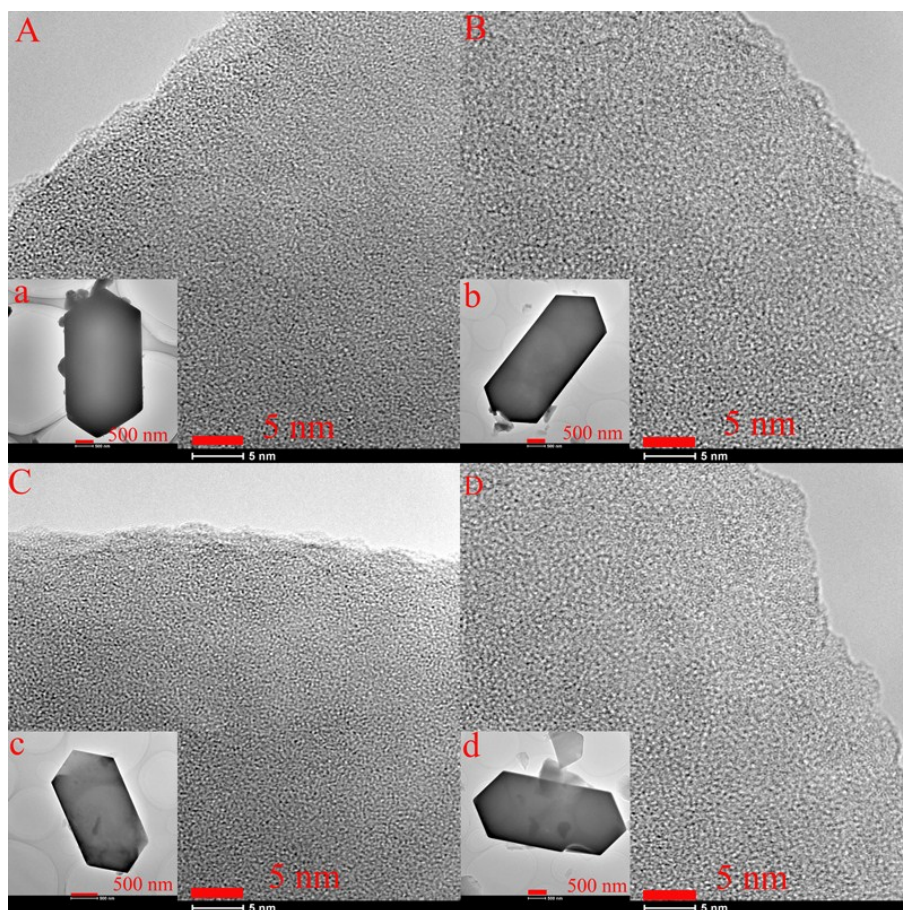


Fig. S1 TEM images of as-prepared catalysts. (A, a) HZSM-5; (B, b) Ga/IM; (C, c) Ga/IMRO1C; (D, d) Ga/IMRO3C.

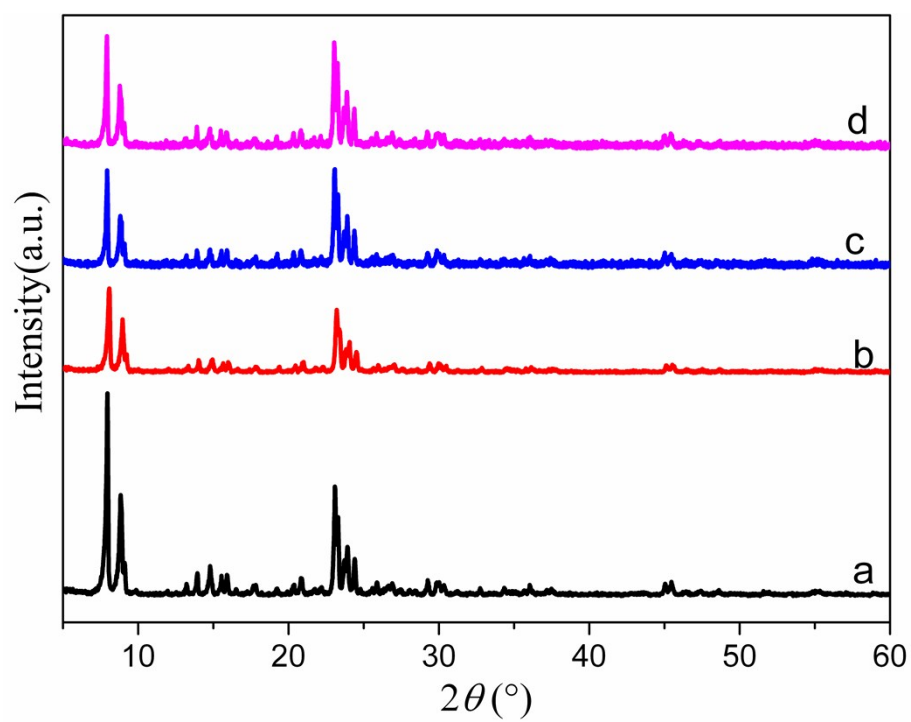


Fig. S2 XRD patterns of as-prepared samples. (a) HZSM-5; (b) Ga/IM; (c) Ga/IMRO1C; (d) Ga/IMRO3C.

Table S1 Acid site concentrations determined by NH₃ -TPD for different catalysts.

Catalysts	Total acidity (m mol g ⁻¹)	Weak acidity (m mol g ⁻¹)	Strong acidity (m mol g ⁻¹)	W/S
HZSM-5	0.47	0.26	0.21	1.2
Ga/IM	0.43	0.23	0.20	1.1
Ga/IMRO1C	0.38	0.25	0.13	1.9
Ga/ IMRO3C	0.37	0.25	0.12	2.1

Table S2 Summary of H₂-TPR results of percentage composition for as-prepared samples. This table suggests the percentage compositions of (GaO)⁺ on Ga/IMRO1C and Ga/IMRO3C are higher than that on Ga/IM.

Samples	Peak I(%)	Peak II(%)	Peak III(%)
Ga ₂ O ₃	507(93.8)	/	772(6.20)
Ga/IM	528(94.2)	671(2.40)	810(3.40)
Ga/IMRO1C	522(78.1)	692(21.9)	/
Ga/IMRO3C	392(77.2)	655(22.8)	/

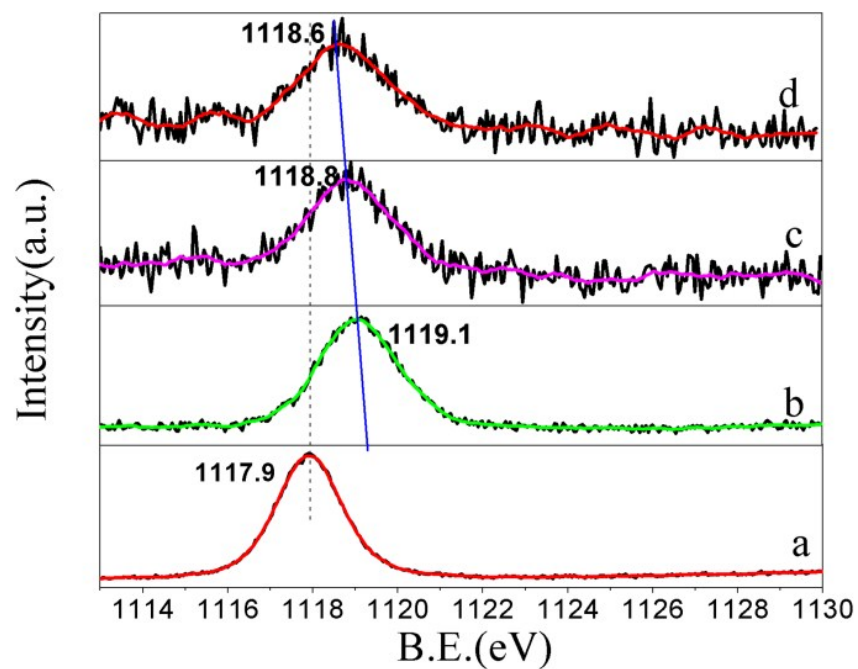


Fig. S3 Ga 2p_{3/2} XPS spectra of different samples. (a) Ga₂O₃; (b) Ga/IM; (c) Ga/IMRO1C; (d) Ga/IMRO3C.

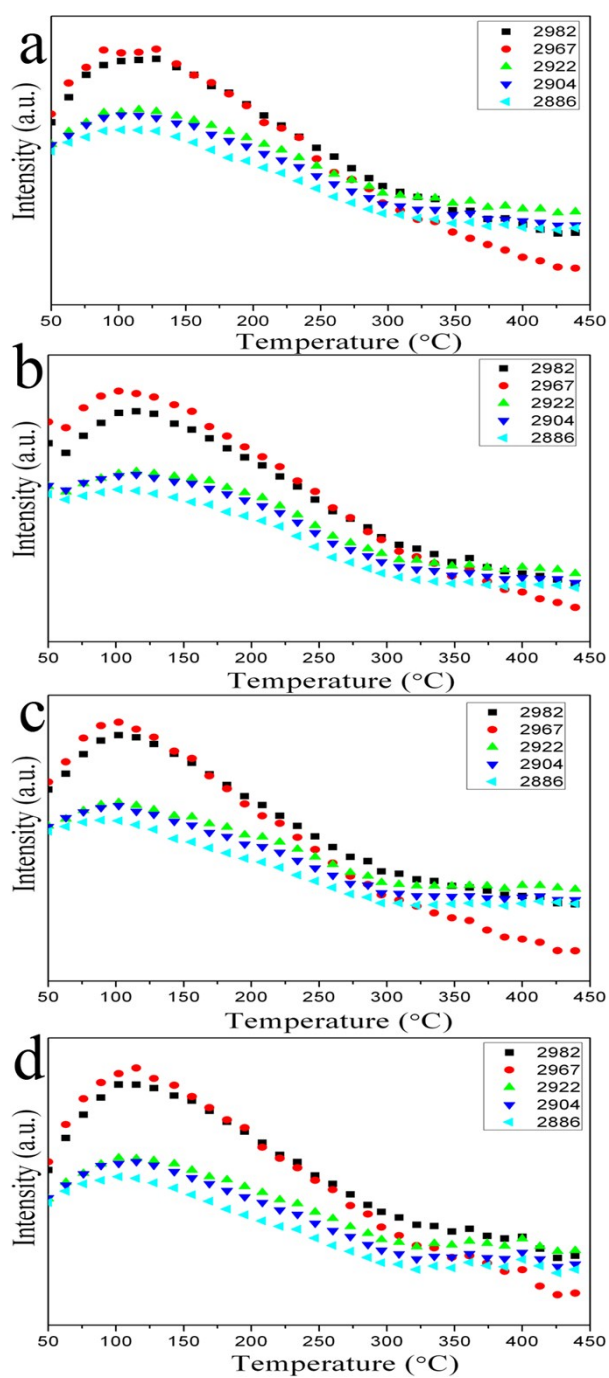


Fig. S4 (a-d) Peak intensity of C-H groups on different catalysts as a function of temperature during propane-TPSR experiment at the region 2800-3100cm⁻¹. (a) HZSM-5; (b) Ga/IM; (c) Ga/IMRO1C; (d) Ga/IMRO3C.

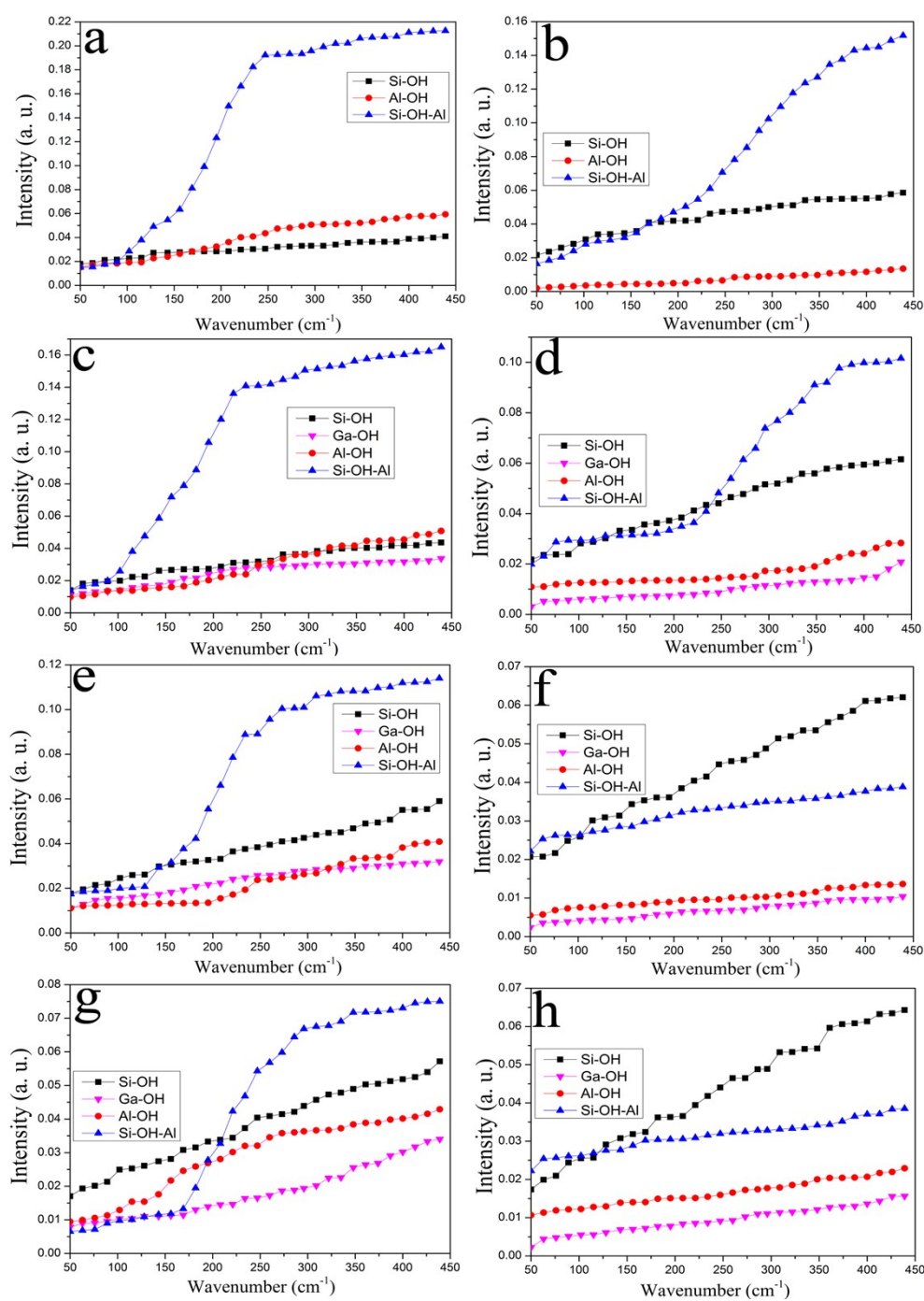


Fig. S5 (a-h) Intensity of Si(OH)Al, Al-OH, Ga-OH and Si-OH groups peaks for as-prepared samples as a function of temperature during propane-TPSR experiment. (a) HZSM-5 (without introduction of propane); (b) HZSM-5; (c) Ga/IM (without introduction of propane); (d) Ga/IM; (e) Ga/IMRO1C(without introduction of propane); (f) Ga/IMRO1C; (g) Ga/IMRO3C (without introduction of propane); (h) Ga/IMRO3C.

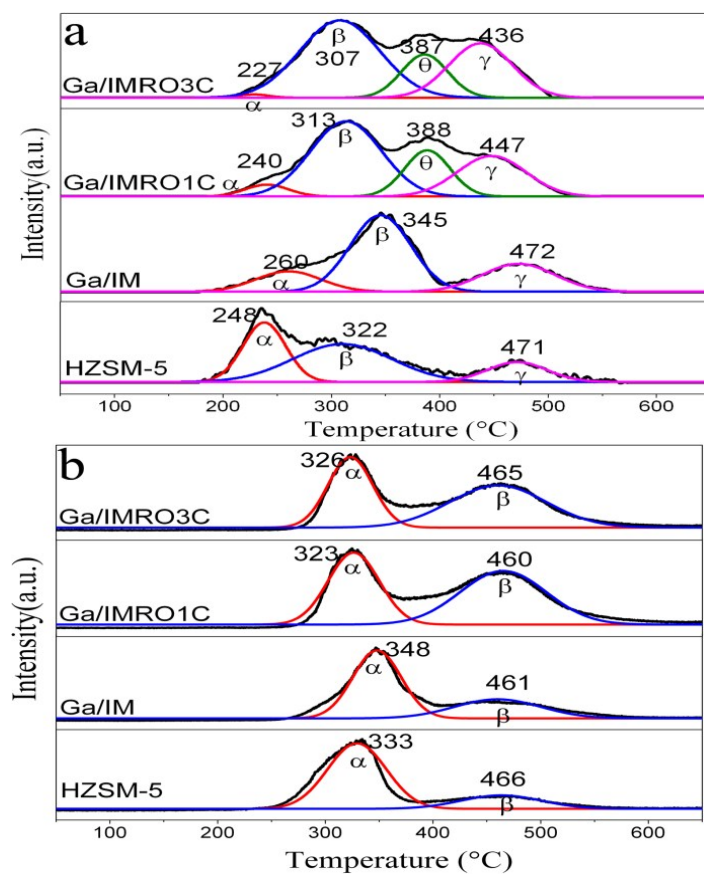


Fig. S6 Curve-fitting results of hydrogen (a) and benzene (b) profiles for as-prepared catalysts in propane-TPSR experiment.

Table S3 MS-TPSR results of propane adsorbed on the HZSM-5 zeolites

	Temperature region I (150-270°C)		Temperature Region II (270-400 °C)		Temperature region III (400-550 °C)	
Desorption	Desorption peak	Peak	Desorption peak	Peak	Desorption peak	Peak
species	temperature (°C)	intensity	temperature (°C)	intensity	temperature (°C)	intensity
propane	236	weak	/	/	/	/
methane	222	strong	270-360	weak	/	/
ethene	235	weak	270-370	weak	/	/
propene	234	strong	270-350	weak	/	/
hydrogen	235	weak	/	/	450-500	weak
benzene	/	/	333	strong	466	weak
toluene	/	/	347	strong	400-520	weak
xylene	/	/	363	weak	/	/

Table S4 MS-TPSR results of propane adsorbed on the Ga/IM zeolites.

	Temperature region I (150-270°C)		Temperature region II (270-400 °C)		Temperature region III (400-550 °C)	
Desorption	Desorption peak	Peak	Desorption peak	Peak	Desorption peak	Peak
species	temperature (°C)	intensity	temperature (°C)	intensity	temperature (°C)	intensity
propane	231	weak	/	/	/	/
methane	220	strong	347	weak	/	/
ethene	170-270	weak	270-370	weak	/	/
propene	228	strong	/	/	/	/
hydrogen	160-270	weak	345	weak	461	weak
benzene	/	/	348	strong	410-550	weak
toluene	/	/	355	strong	410-550	weak
xylene	/	/	366	strong	/	/

Table S5 MS-TPSR results of propane adsorbed on the Ga/IMRO1C

	Temperature region I (150-270°C)		Temperature region II (270-400 °C)		Temperature region III (400-550 °C)	
Desorption	Desorption peak	Peak	Desorption peak	Peak	Desorption peak	Peak
species	temperature (°C)	intensity	temperature (°C)	intensity	temperature (°C)	intensity
propane	238	weak	/	/	/	/
methane	228	strong	270-360	weak	/	/
ethene	180-270	weak	270-360	weak	/	/
propene	242	strong	/	/	/	/
hydrogen	160-270	weak	270-350, 350-400	weak	400-550	weak
benzene	/	/	323	strong	460	strong
toluene	/	/	330	strong	400-550	strong
xylene	/	/	348	strong	/	/

Table S6 MS-TPSR results of propane adsorbed on the Ga/IMRO3C

	Temperature region I (150-270°C)		Temperature region II (270-400 °C)		Temperature region III (400-550 °C)	
Desorption	Desorption peak	Peak	Desorption peak	Peak	Desorption peak	Peak
species	temperature (°C)	intensity	temperature (°C)	intensity	temperature (°C)	intensity
propane	236	weak	/	/	/	/
methane	224	strong	270-360	weak	/	/
ethene	180-270	weak	270-360	weak	/	/
propene	239	strong	/	/	/	/
hydrogen	160-270	weak	270-350, 350-400	weak	400-540	weak
benzene	/	/	326	strong	465	strong
toluene	/	/	327	strong	400-520	strong
xylene	/	/	340	strong	/	/