Supplementary Materials

Selective Conversion of Bio-Derived Ethanol to Renewable BTX over Ga-ZSM-5

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Table S1. Unit cell parameters obtained from the Rietveld refinements and calculated cell volumes for the ZSM-5 phase.

Sample	a (Å)	b (Å)	c (Å)	Volume (Å^3)
H-ZSM-5	20.14	19.95	13.42	5392
6.2% Ga-ZSM-5	20.14	19.94	13.42	5389
1.7% Ga-ZSM-5	20.13	19.93	13.41	5378
Physical mixture 5.9% Ga_2O_3/H-ZSM-5	20.14	19.94	13.42	5388

Table S2. Surface species atomic ratio based on the XPS analysis

	Si/Al	Ga/Si
4.4% Ga-ZSM-5 with uniform distribution	11.5	0.05
4.4% Ga-ZSM-5	13.8	0.11

Table S3. Liquid (C_{5+}) hydrocarbon distributions for various catalysts at 450 ºC and 1.6 h^{-1}

	C_{5+} product distribution, wt%					C_{5+} yield
	Paraffins	Olefins	Aromatics	BTX	Benzene	
H-ZSM-5	6.6	10.6	82.8	80.3	14.1	25.5
Physical mixture Ga_2O_3/H-ZSM-5 (5.9%) before reduction	6.9	14.0	79.1	74.1	12.0	26.4
Physical mixture Ga_2O_3/H-ZSM-5 (15%) before reduction	7.2	9.6	83.2	79.0	13.1	24.7
Physical mixture Ga_2O_3/H-ZSM-5 (50%) before reduction	9.6	9.3	81.1	77.0	12.8	24.2
Physical mixture Ga_2O_3/H-ZSM-5 (5.9%) after reduction	0.6	0.7	99	94	22.9	52
4.4% Ga-ZSM-5 ion exchange	0.9	2.0	97	88	23.6	52
Physical mixture Ga_2O_3/H-ZSM-5 (15%) after reduction	1.6	2.2	96	90	20.9	47
Physical mixture Ga_2O_3/H-ZSM-5 (50%) before reduction	1.7	2.5	96	88	20	44

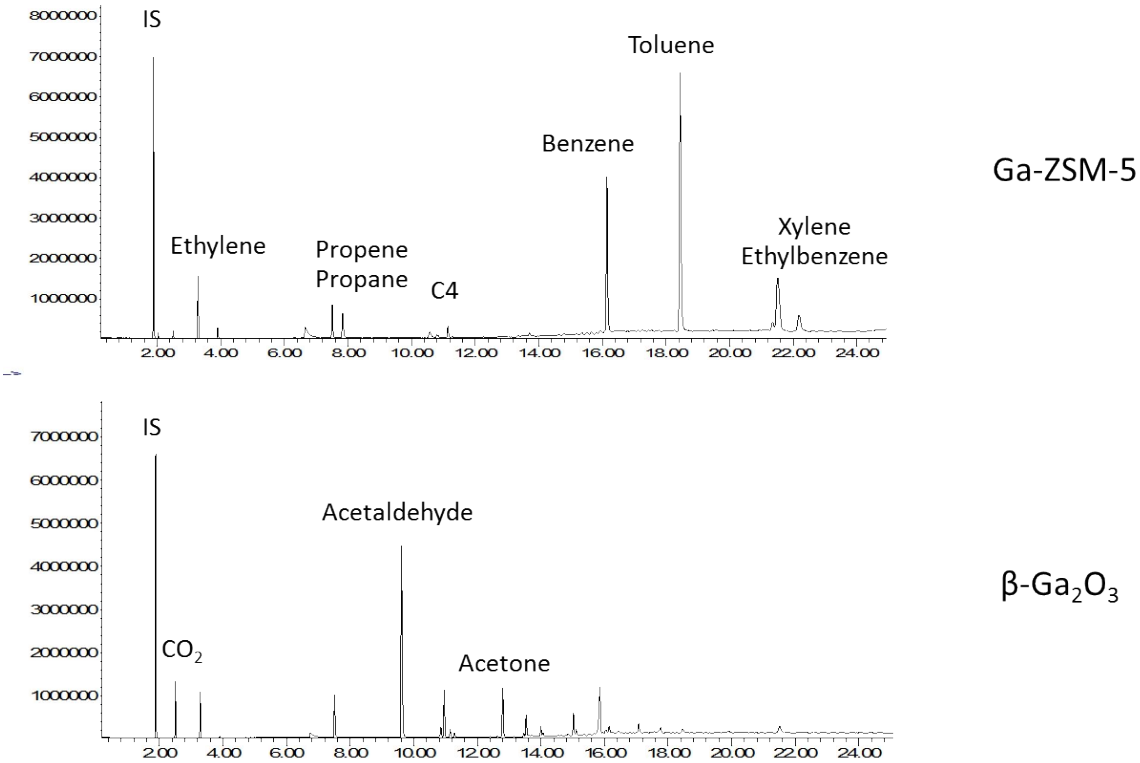


Fig. S1. GC chromatography comparison between Ga-ZSM-5 and β-Ga_2O_3. IS: internal standard nitrogen

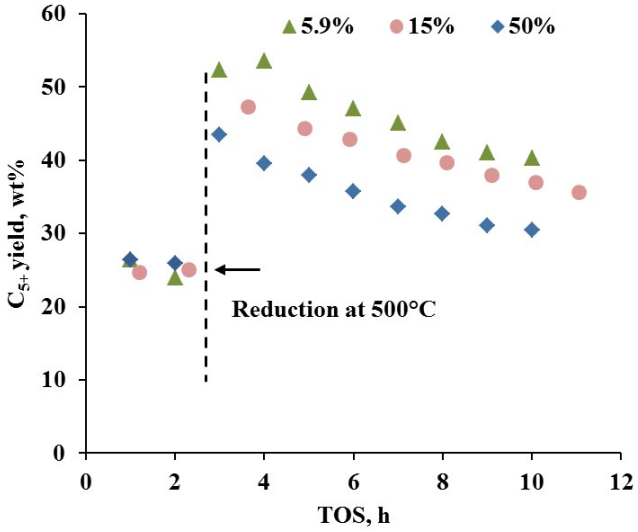


Fig. S2. C_{5+} yield for physical mixtures of Ga_2O_3/H-ZSM-5 with different Ga loadings before and after hydrogen reduction pretreatment at 500 ºC. Reaction condition: 450 ºC and 1.6 h^{-1}.

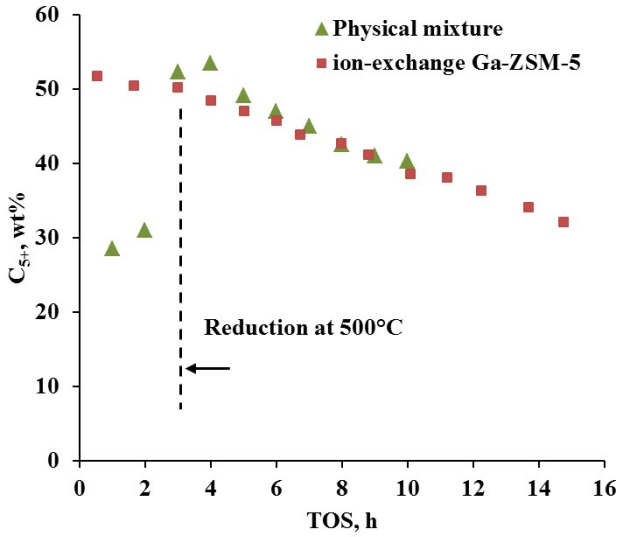
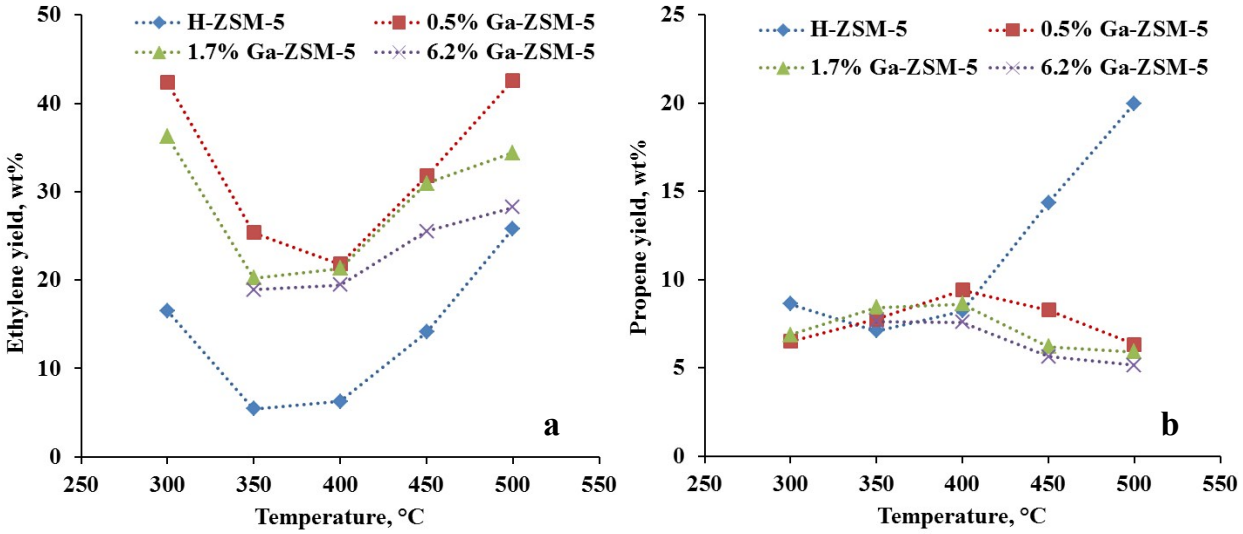


Fig. S3. Liquid (C_{5+}) hydrocarbon yield for ion-exchange 4.4% Ga-ZSM-5 and physical mixture 5.9% Ga_2O_3/H-ZSM-5 (Ga loading: 4.4%) before and after hydrogen reduction at 500 ºC, the ethanol reaction is performed at 450 ºC and 1.6 h^{-1}.



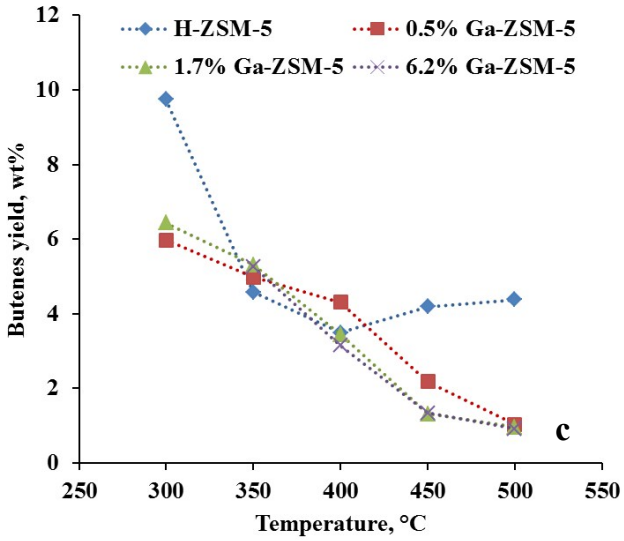


Fig. S4. (a) Ethylene, (b) propene and (c) butenes yield vs temperature for H-ZSM-5 and Ga-ZSM-5 with different Ga loadings