Supplementary Information (ESI)

Higher BTEX aromatic yield from ethanol over desilicated H,Zn-[Al]ZSM-5 catalysts

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Table S1: Conditions for the synthesis of zinc exchanged ZSM-5.

Sample	Parent material	Subsequent ion exchanges
0.7Zn/Z11	Z11	1[a]
1.0Zn/Z11	Z11	2[a]
2.5Zn/Z11	Z11	2
3.1Zn/Z11	Z11	4
1.5Zn/D11	D11	2
2.0Zn/D11	D11	4
0.5Zn/Z29	Z29	2
0.7Zn/Z29	Z29	4
0.6Zn/D29	D29	2
1.0Zn/D29	D29	4

[a] Concentration during ion exchange: 31 g/L

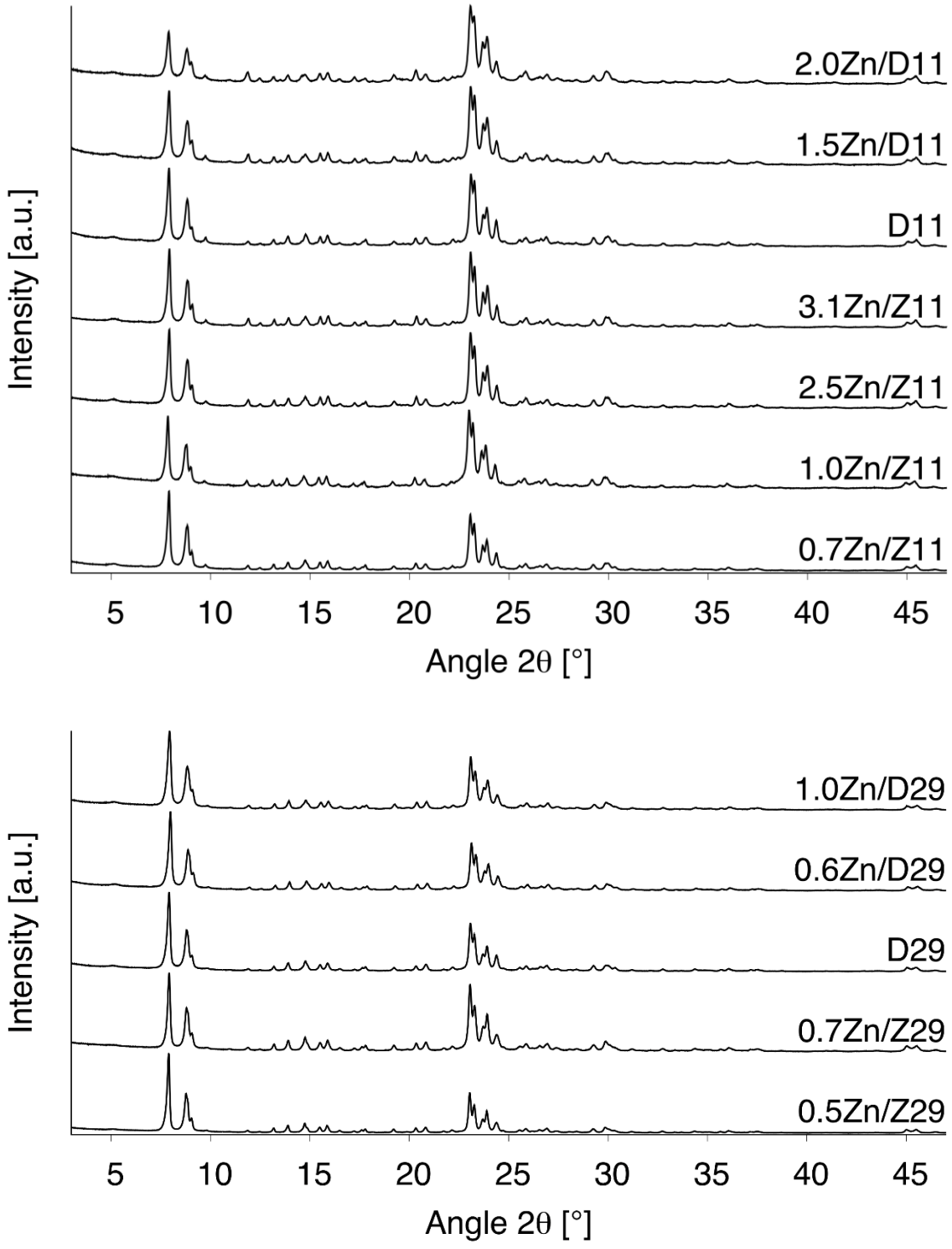

Figure S1. X-ray powder diffraction patterns of the MFI zeolites. Intensities are normalized.

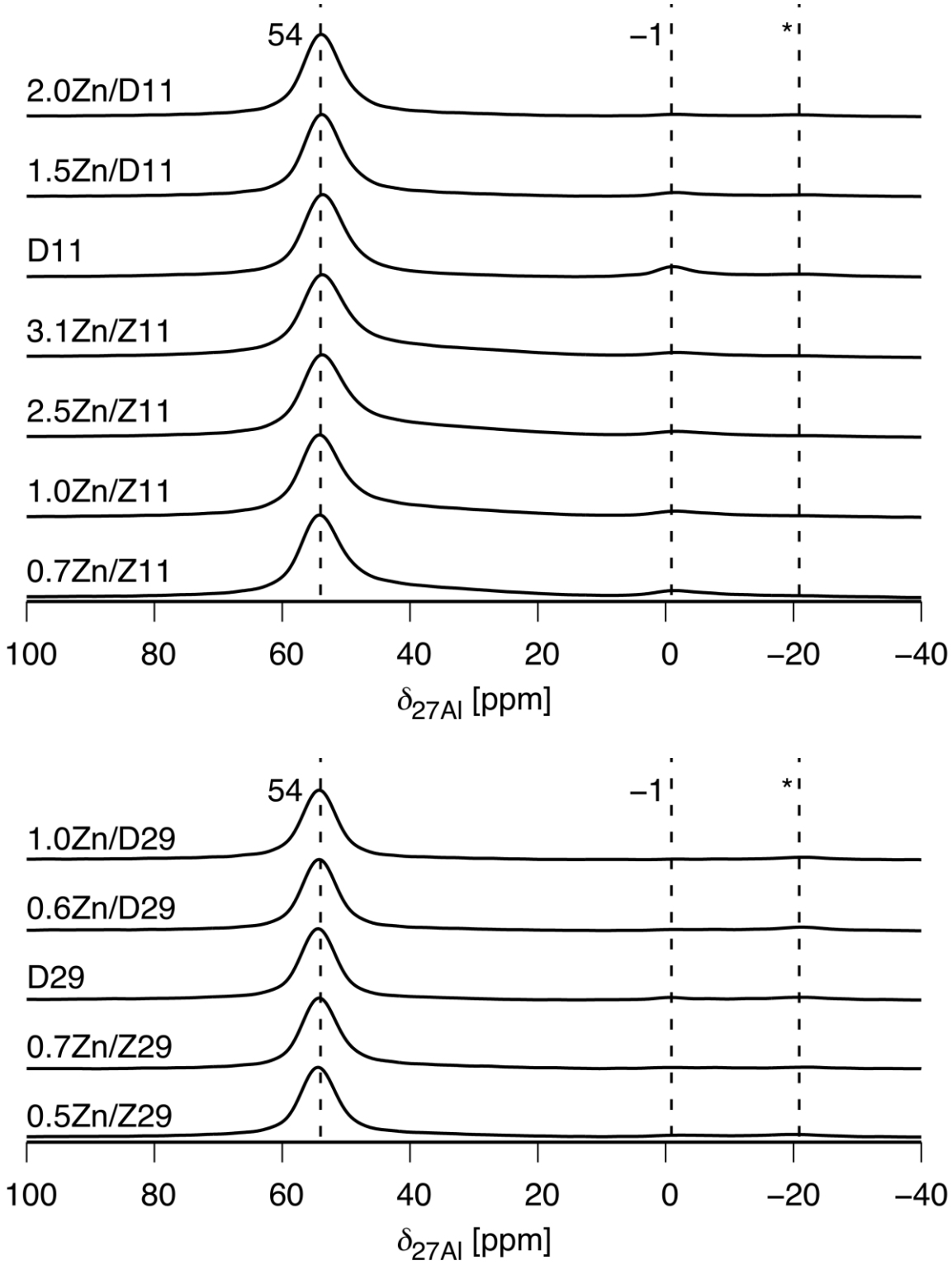

Figure S2: ^{27}Al MAS NMR spectra of the Z11-derived (top) and Z29-derived (bottom) materials. Spinning sidebands indicated by asterisk (*).

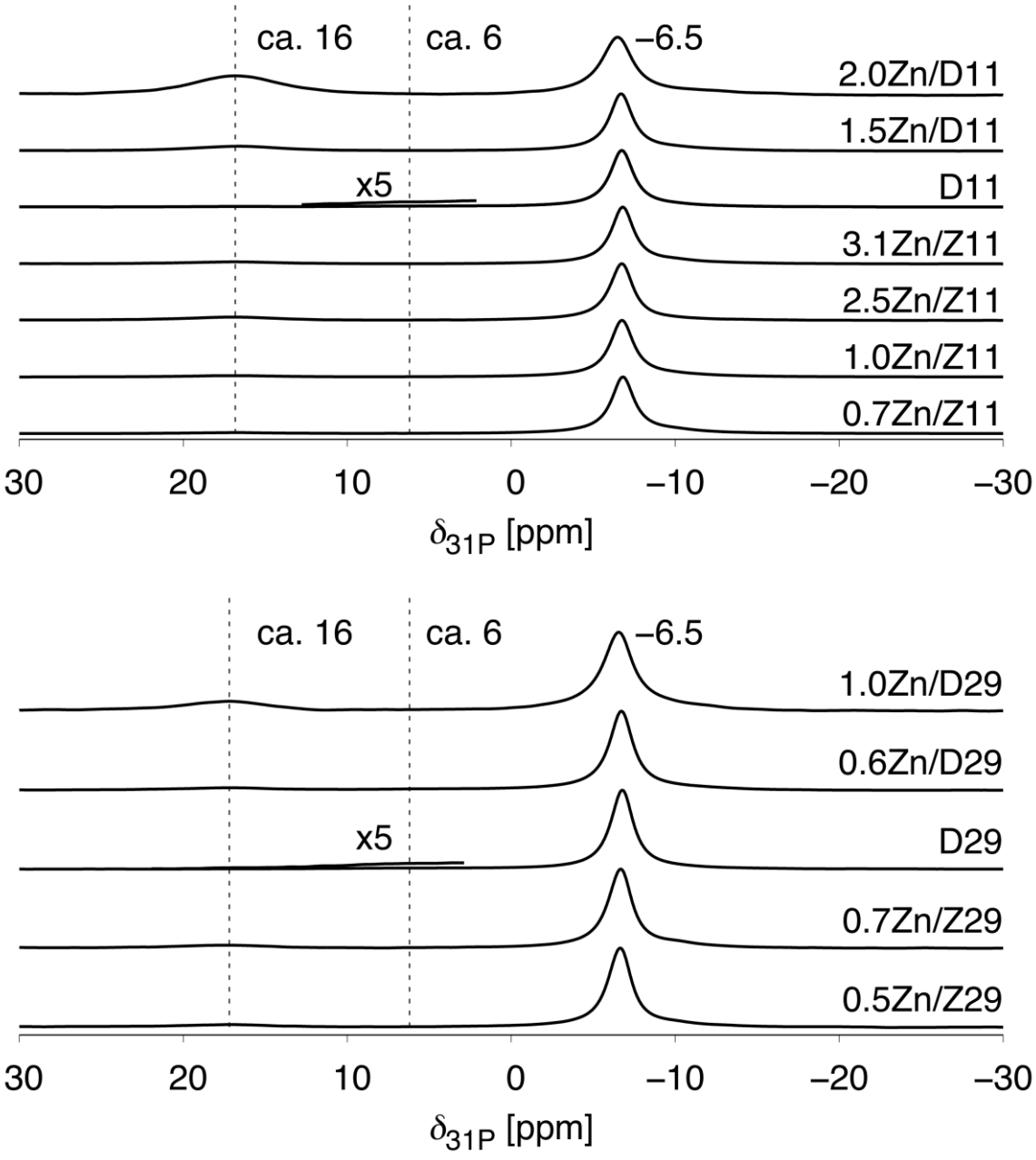

Figure S3: ^{31}P MAS NMR spectra of the Z11-derived (top) and Z29-derived (bottom) materials loaded with TPP.

Catalytic data of ZSM-5 catalysts

Color coding for the Product Distribution:

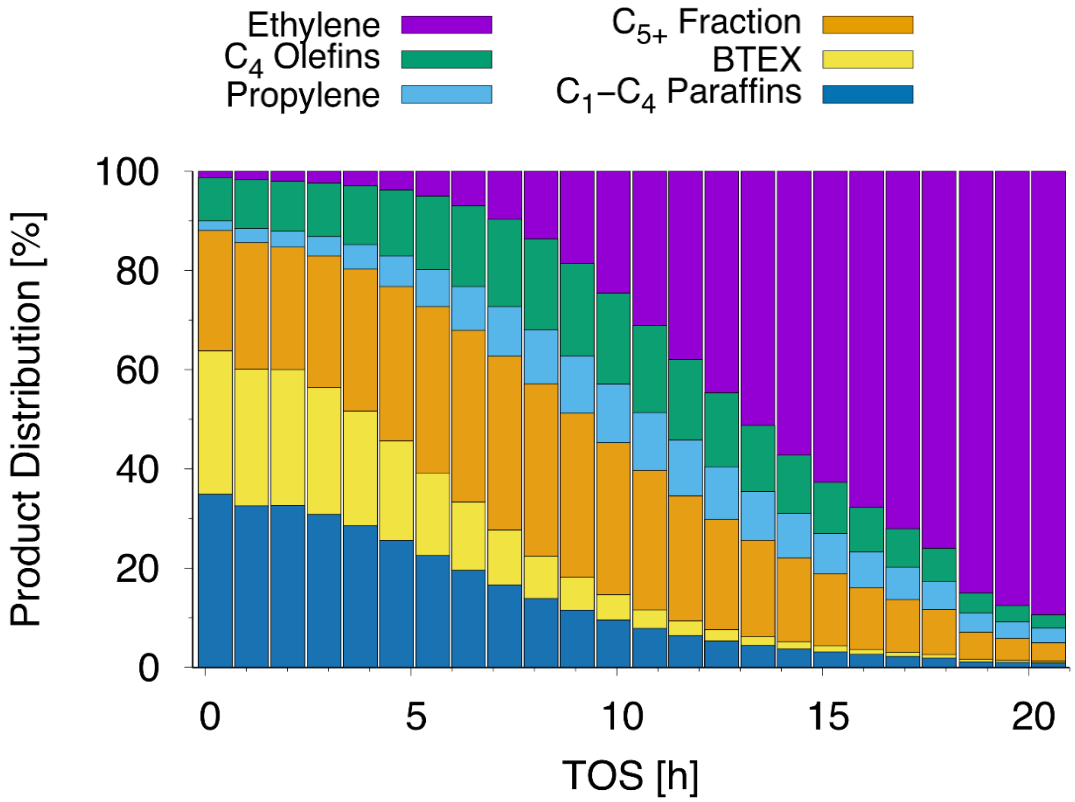

Figure S4: Deactivation of Z11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

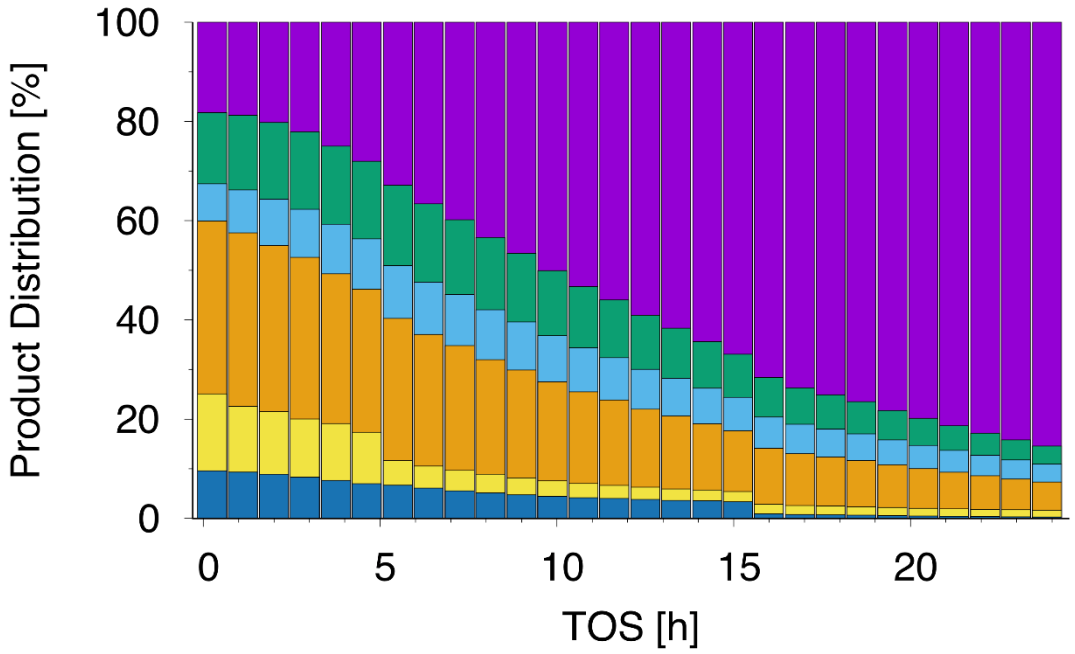

Figure S5: Deactivation of 0.7Zn/Z11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

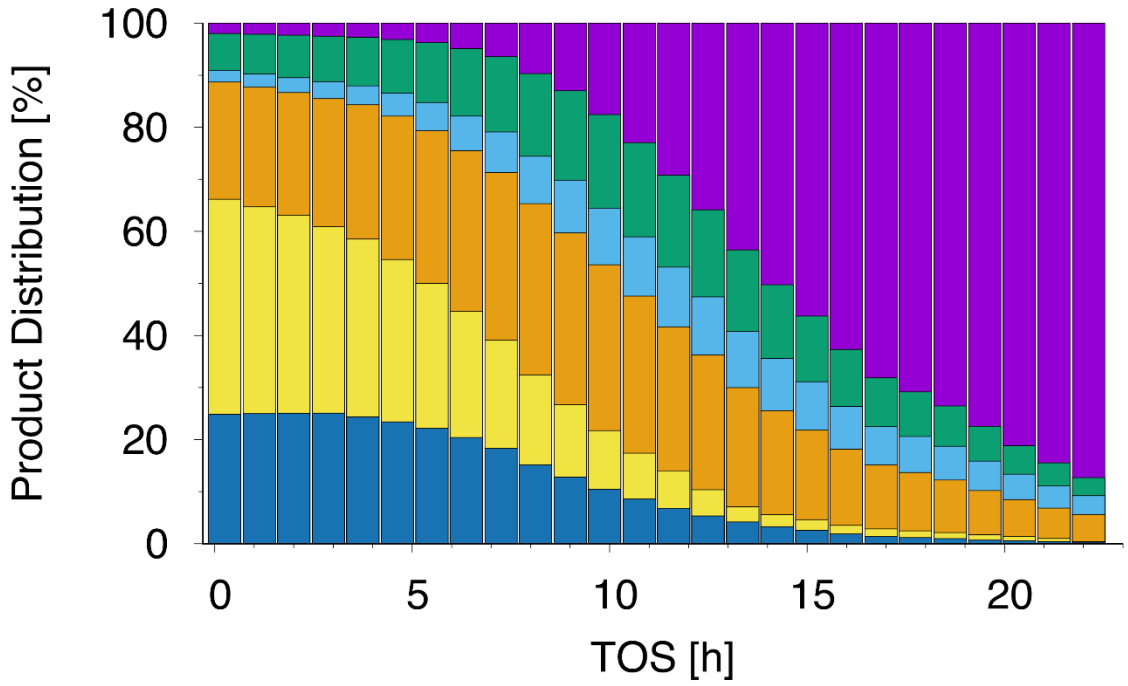

Figure S6: Deactivation of 1.0Zn/Z11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

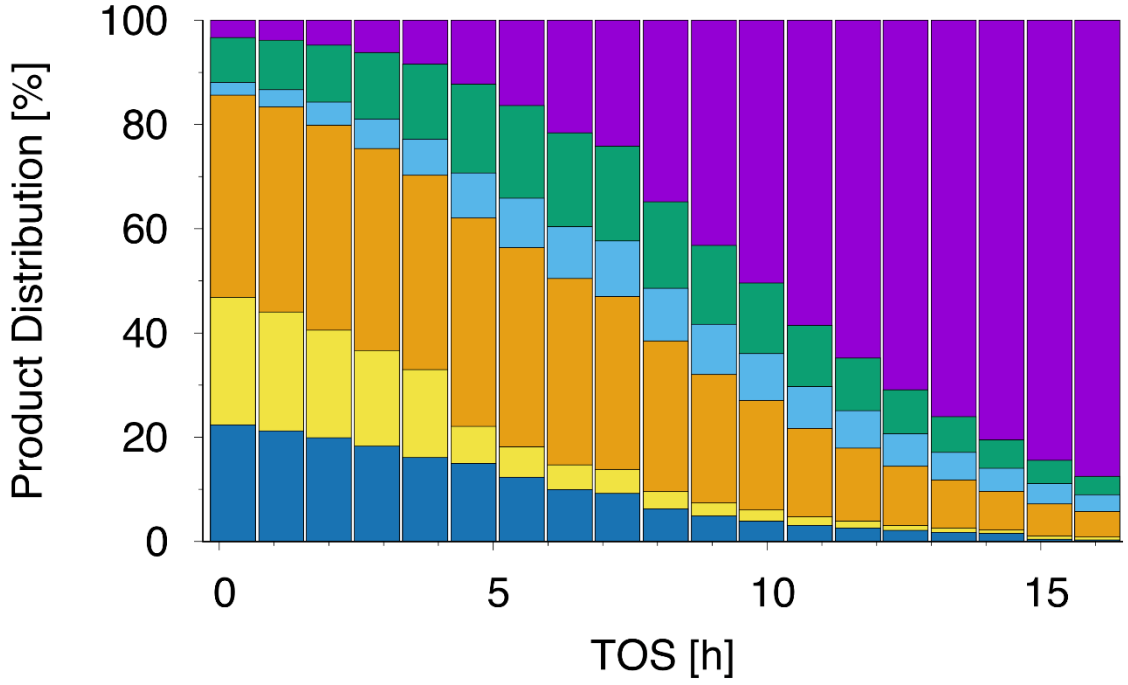

Figure S7: Deactivation of 2.5Zn/Z11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

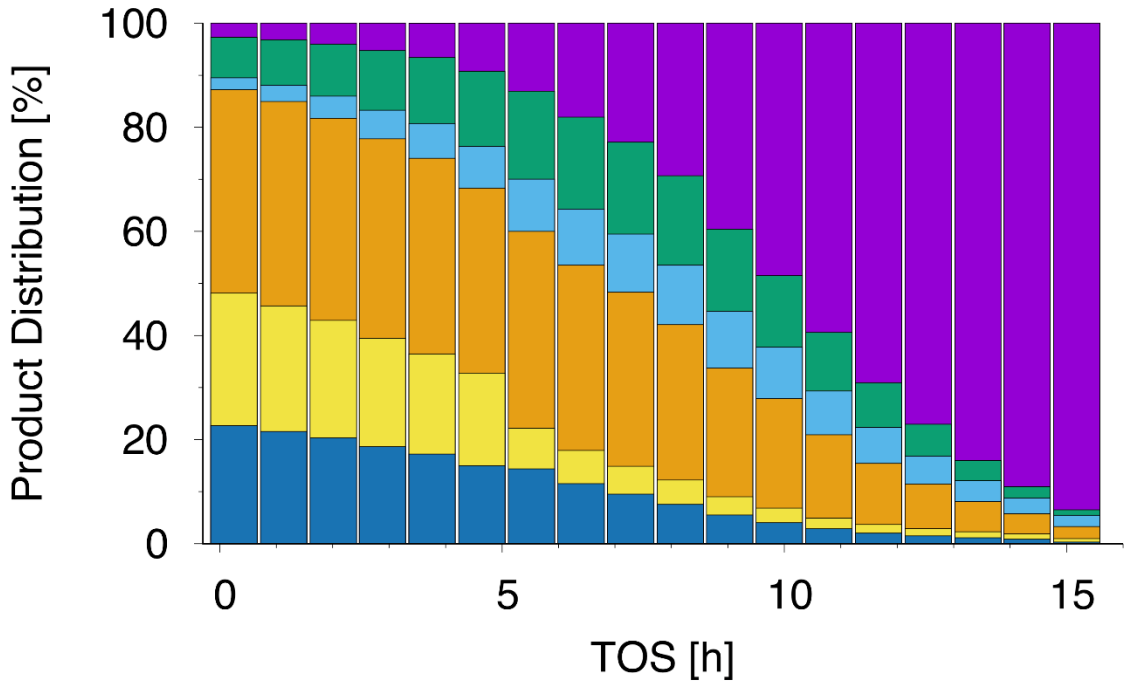

Figure S8: Deactivation of 3.1Zn/Z11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

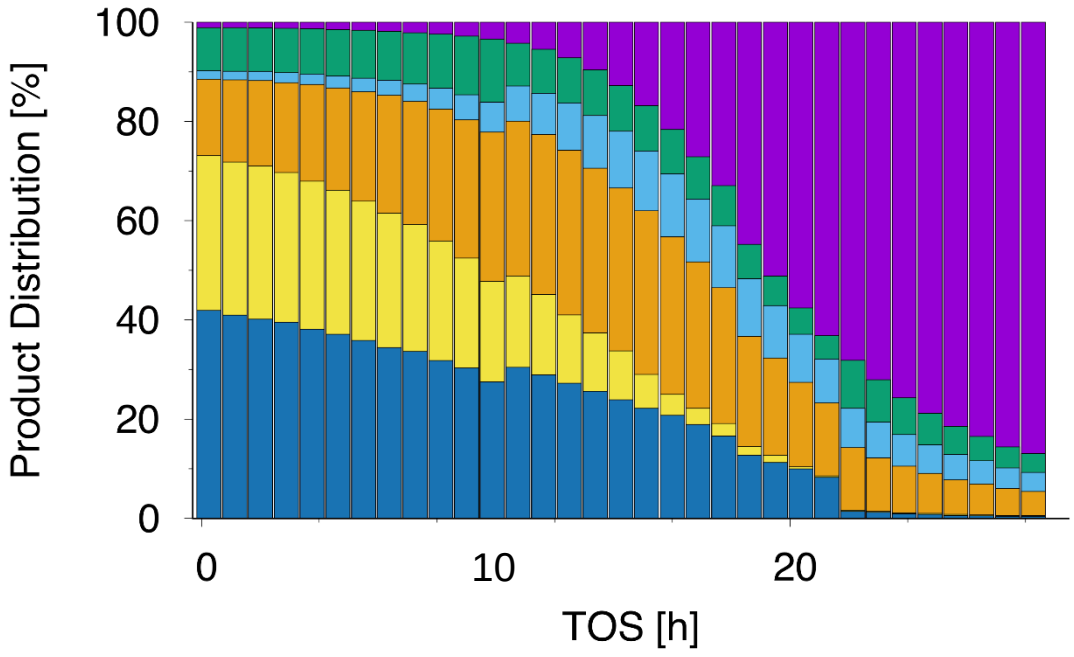

Figure S9: Deactivation of D11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

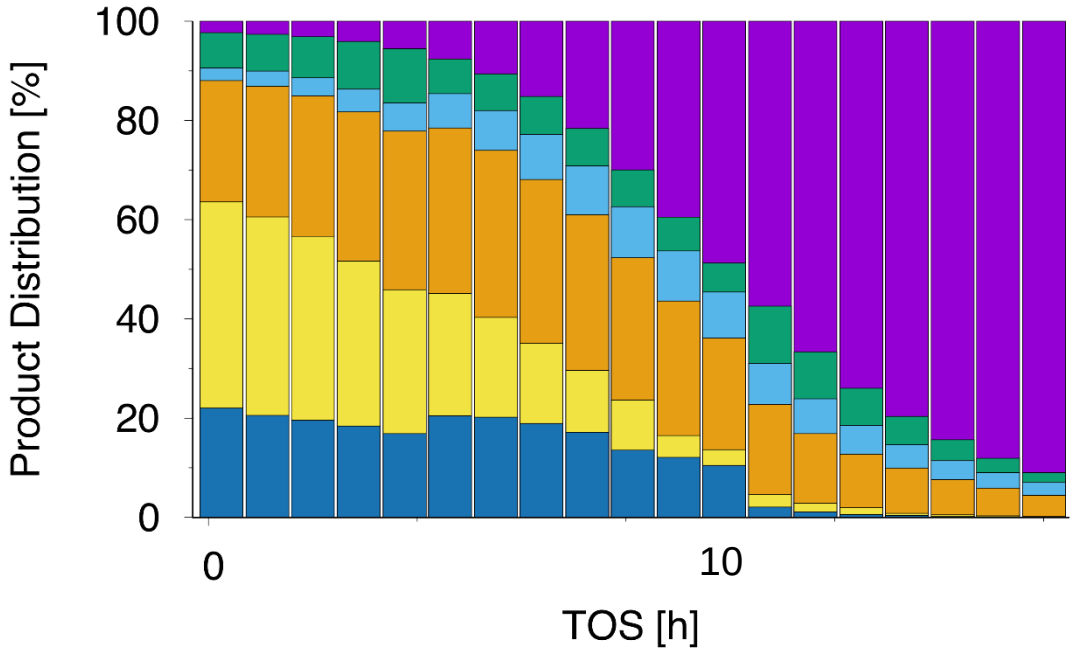

Figure S10: Deactivation of 1.5Zn/D11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

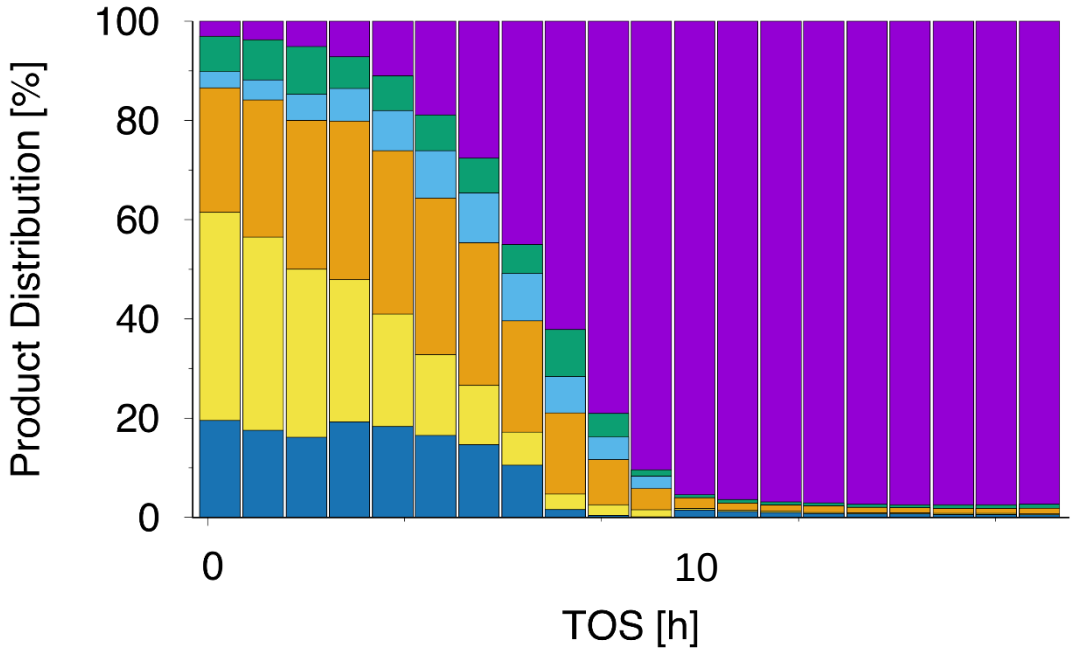

Figure S11: Deactivation of 2.0Zn/D11 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

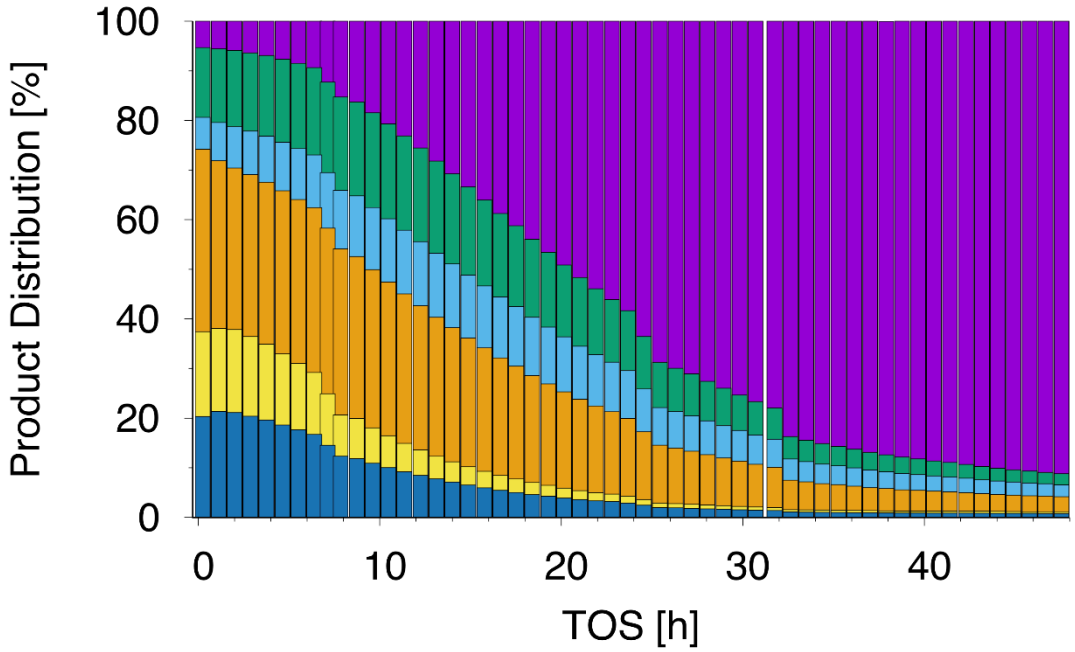

Figure S12: Deactivation of Z29 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

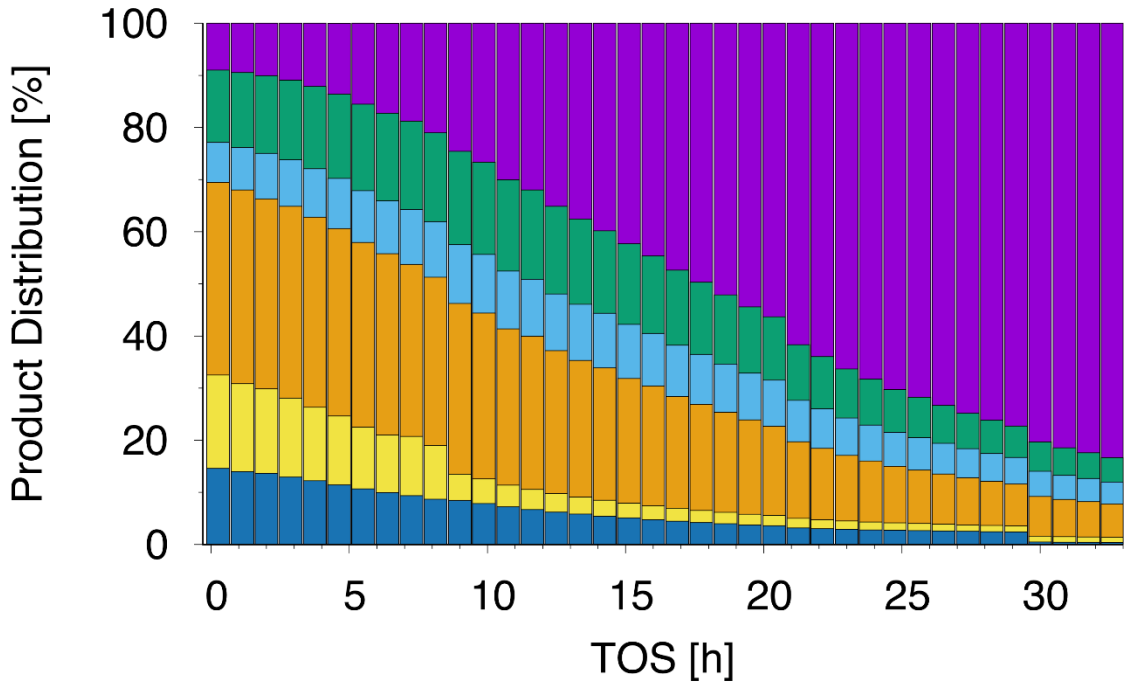

Figure S13: Deactivation of 0.5Zn/Z29 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

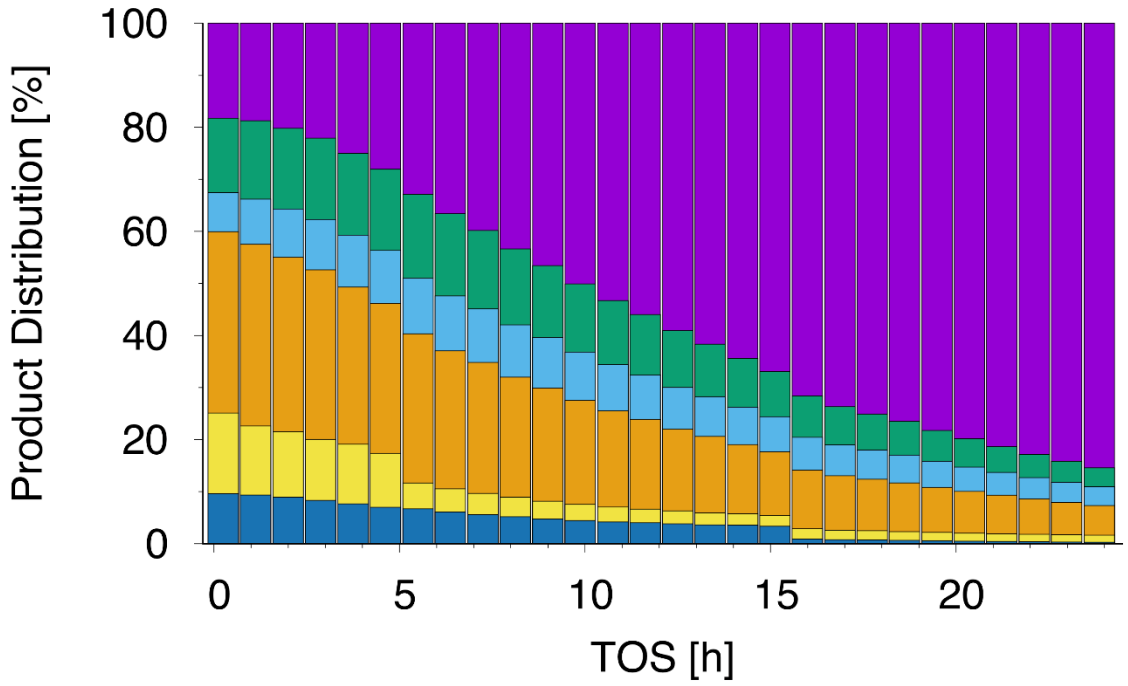

Figure S14: Deactivation of 0.7Zn/Z29 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

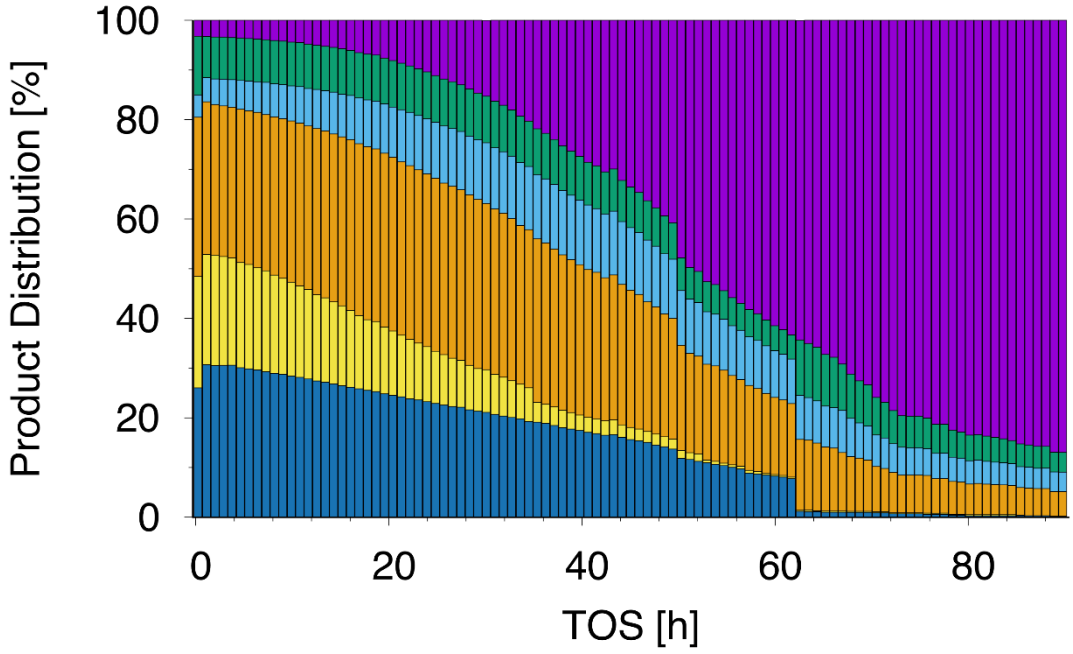

Figure S15: Deactivation of D29 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

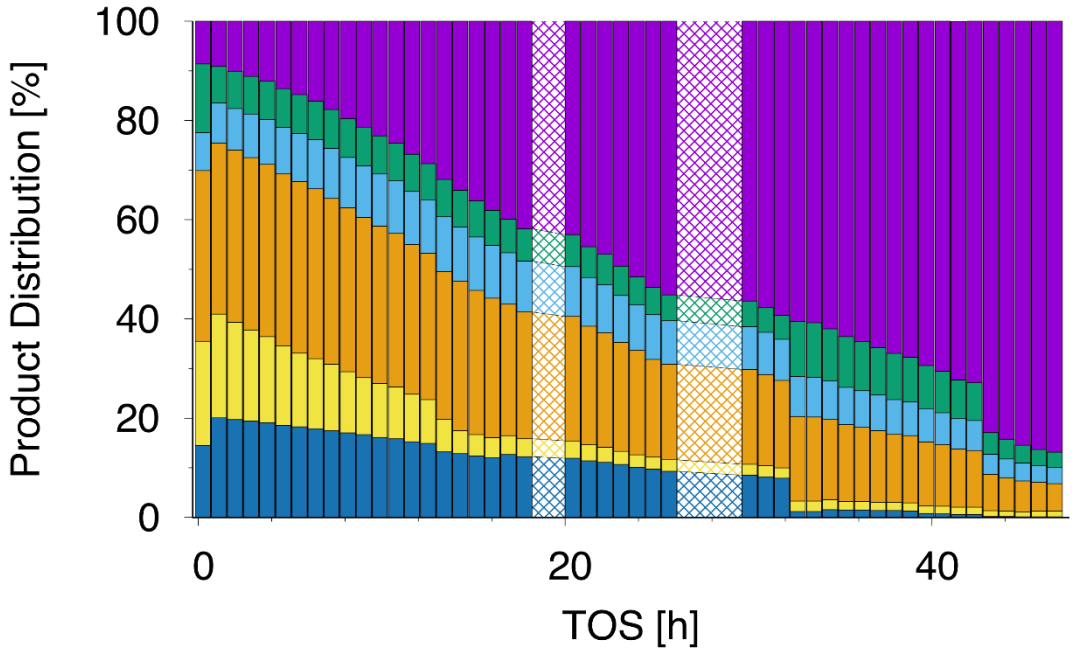

Figure S16: Deactivation of 0.6Zn/D29 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

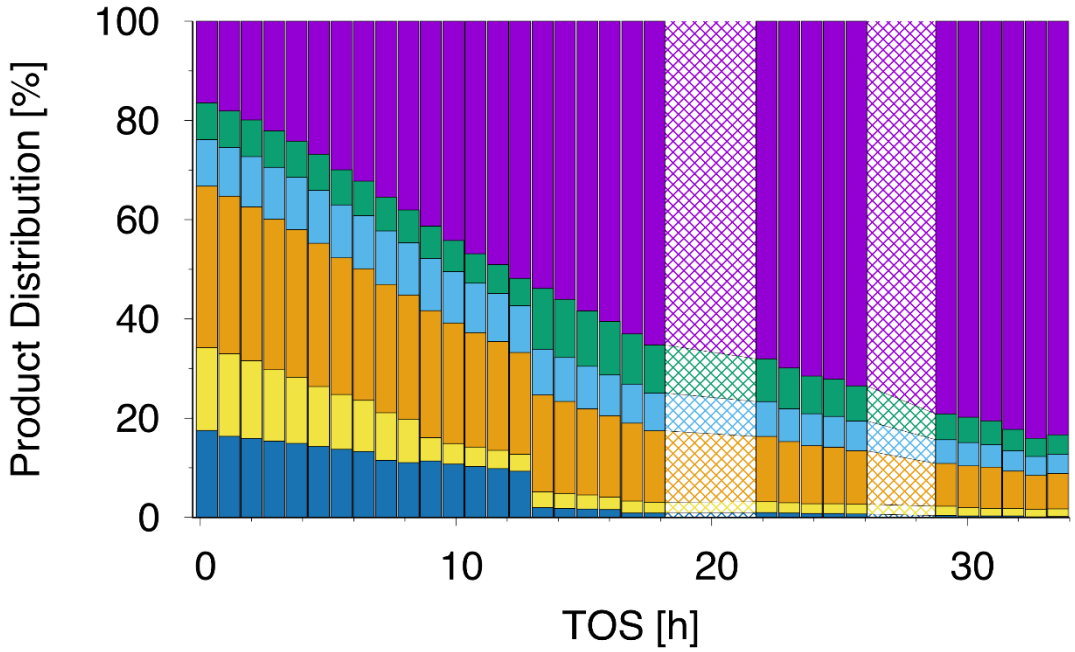

Figure S17: Deactivation of 1.0Zn/D29 at WHSV = 3.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

Table S2: ETA product distribution (in %) at WHSV = 1.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

Kat	**C_1-C_4 Paraffins**	**Ethylene**	**Propylene**	**C_4 Olefins**	**C_5**	**C_{6+}**	**BTEX**
Z11	44.1	0.5	0.7	7.1	6.3	5.3	35.9
0.7Zn/Z11	33.1	0.7	0.7	6.0	5.9	8.2	45.4
1.0Zn/Z11	31.7	0.4	0.4	4.9	4.4	12.8	45.5
2.5Zn/Z11	28.0	0.8	0.8	5.7	6.4	33.0	25.4
3.1Zn/Z11	26.5	0.9	0.8	5.5	6.2	34.1	26.0
D11	46.9	0.4	0.5	6.4	4.2	5.6	36.0
1.5Zn/D11	24.1	0.7	0.6	4.8	5.0	11.9	52.9
2.0Zn/D11	20.6	1.3	1.1	4.8	5.5	14.5	52.2
Z29	34.9	1.6	2.3	9.3	10.5	11.2	30.2
0.5Zn/Z29	22.8	2.6	3.5	7.9	9.3	17.7	36.2
0.7Zn/Z29	19.0	3.7	2.9	9.0	9.5	21.2	34.7
D29	37.6	1.0	1.3	8.6	8.9	12.8	29.8
0.6Zn/D29	20.9	1.9	1.3	6.1	7.4	16.6	45.7
1.0Zn/D29	17.4	2.7	2.8	6.6	8.1	20.4	42.0

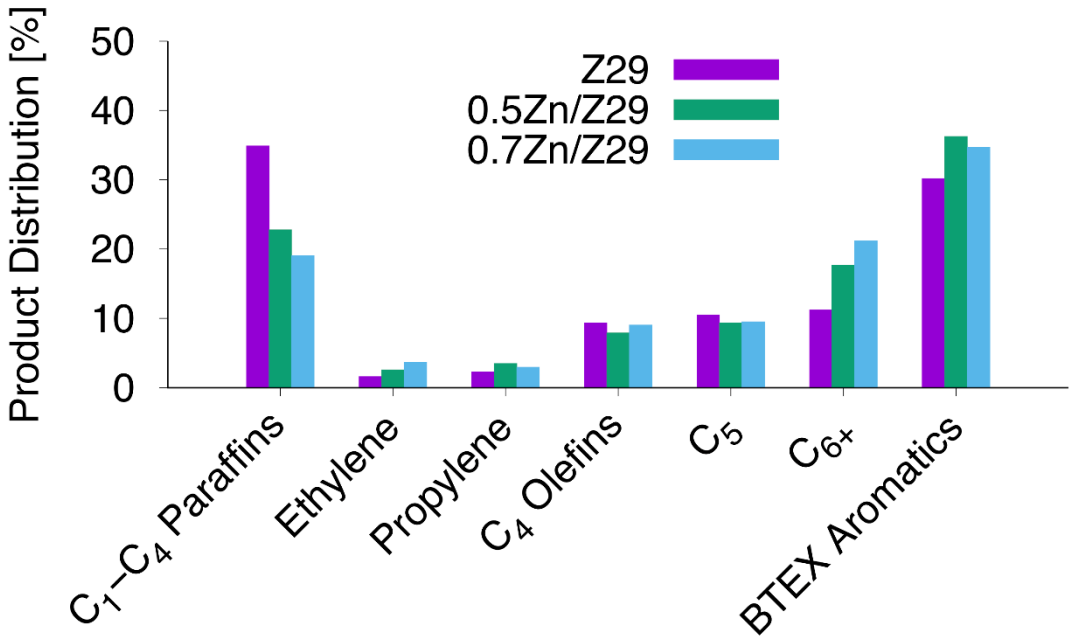

Figure S18: Effect of zinc on the ETA product distribution over Z29-derived samples at WHSV = 1.0 h^{-1}, T = 673 K, p(ethanol) = 0.3 bar, flow = 15 mL min^{-1}.

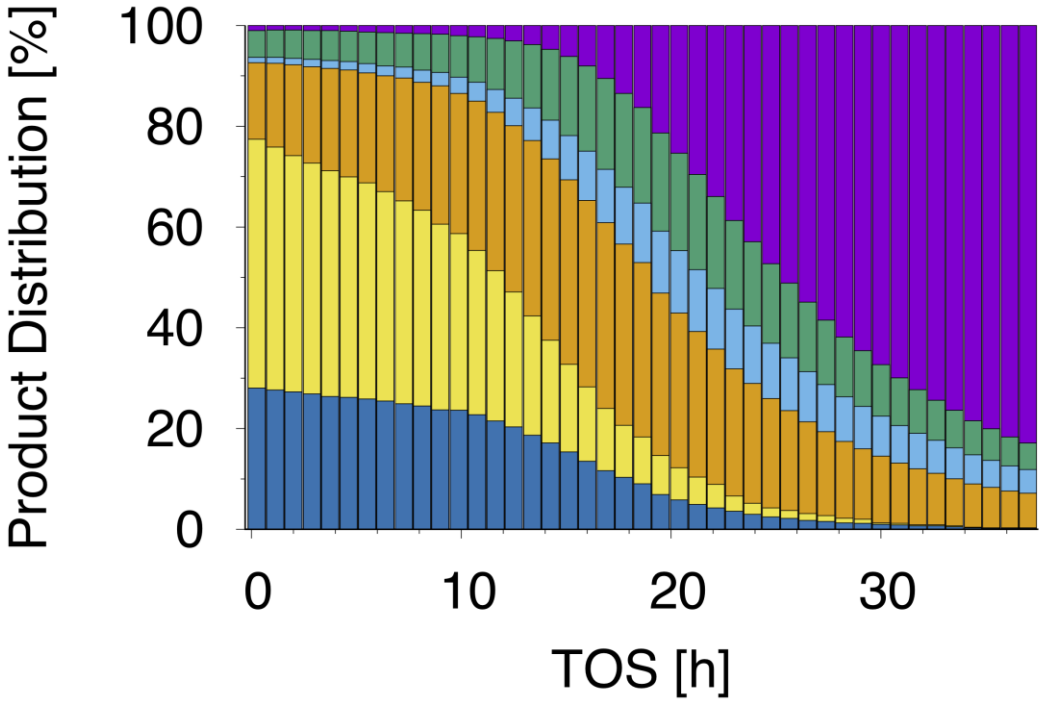

Figure S19: Deactivation of 1.5Zn/D11 at MHSV = 65.1 mol $kg^{-1}h^{-1}$ ethylene, T = 673 K, and flow = 15 mL min^{-1}.

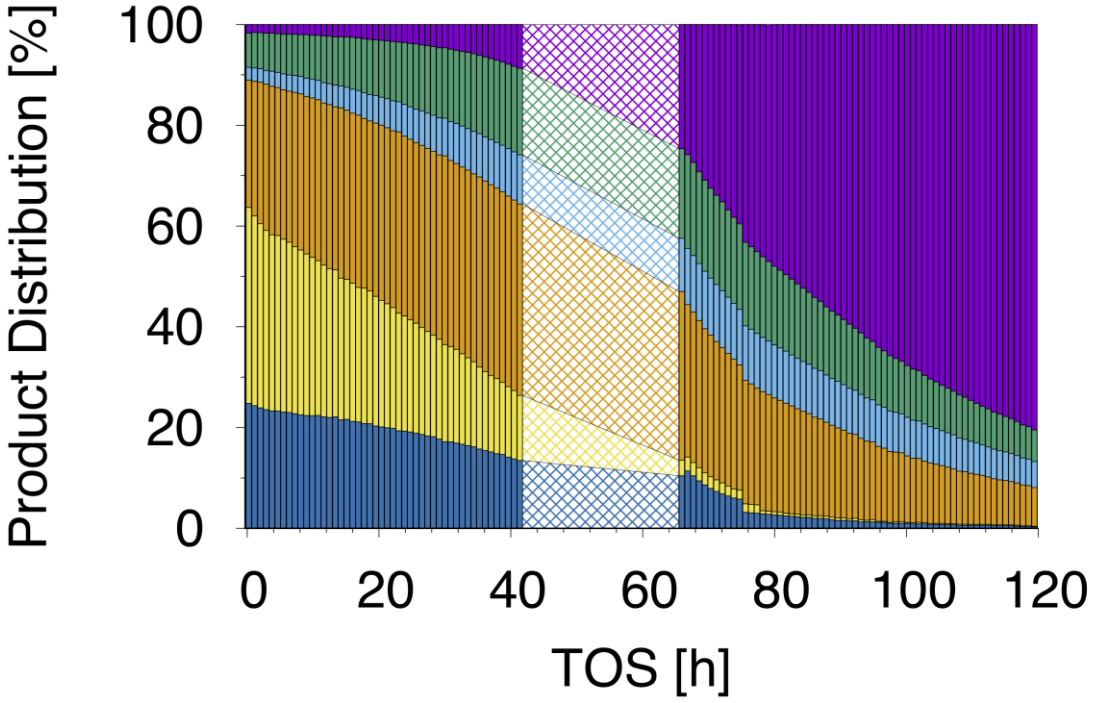

Figure S20: Deactivation of 0.6Zn/D29 at MHSV = 65.1 mol $kg^{-1}h^{-1}$ ethylene, T = 673 K, and flow = 15 mL min^{-1}.

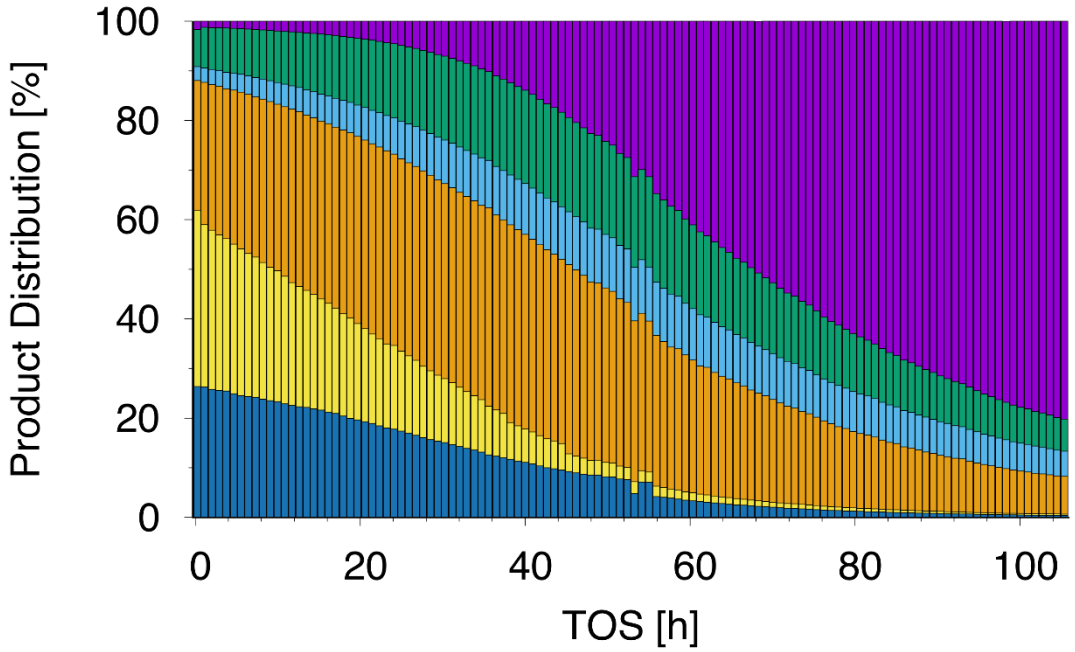

Figure S21: Deactivation of 0.5Zn/Z29 at MHSV = 65.1 mol $kg^{-1}h^{-1}$ ethylene, T = 673 K, and flow = 15 mL min^{-1}.