

	Catalyst loading (g)	Total mol flow rate (*10 ⁻³ mol/min)	Heptane mol concentration	C ₂ H ₄ mol concentration	DMF mol concentration	Pressure (bar)	Conversion	Selectivity	Turn Over Frequency (h ⁻¹)
1	0.1	2.3	29%	70%	1%	55	3.9%	95%	3.3
2	0.1	1.7	39%	60%	1%	55	6.9%	93%	5.7
3	0.1	1.1	61%	37%	2%	55	7.9%	92%	6.5
4	0.1	1.4	24%	75%	1%	55	8.5%	92%	3.9
5	0.1	1.7	39%	60%	1%	55	6.9%	93%	5.7
6	0.1	2.4	55%	43%	2%	55	3.7%	94%	6.1
7	0.1	1.7	39%	60%	1%	69	9.0%	87%	7.0
8	0.1	1.7	39%	60%	1%	55	6.9%	93%	5.7
9	0.1	1.7	39%	60%	1%	41	4.9%	94%	4.1
10	0.1	1.7	39%	60%	1%	28	2.8%	97%	2.4
11	0.1	1.7	39%	60%	1%	10	1.2%	99.5%	3.1
12	0.1	1.7	39%	60%	1%	55	6.9%	93%	5.7
13	0.1	1.7	37%	60%	3%	55	6.1%	85%	11.6
14	0.1	1.7	35%	59%	6%	55	5.7%	74%	18.8
15	0.05	1.7	39%	60%	1%	55	14%	85%	5.9
16	0.1	1.7	39%	60%	1%	55	6.9%	93%	5.7
17	0.2	1.7	39%	60%	1%	55	3.4%	98.5%	5.3

Table S1 Reaction results on Sn-BEA at 650 K with different partial pressure of C₂H₄ and 2,5-dimethylfuran

Catalyst	Total mol flow rate (*10 ⁻³ mol/min)	Heptane mol concentration	C ₂ H ₄ mol concentration	DMF mol concentration	Temperature (°C)	Conversion	Selectivity	Reaction rate (1/(site.h))
H-BEA	1.7	38.9%	59.9%	1.2%	350	11.4%	48%	1.3
H-BEA	1.7	37.4%	59.6%	3.0%	350	11.8%	45%	3.3
H-BEA	1.7	34.9%	59.1%	6.0%	350	12.5%	43.5%	6.8
Zr-BEA	1.7	38.9%	59.9%	1.2%	375	5.8%	88%	9.7
Zr-BEA	1.7	37.4%	59.6%	3.0%	375	5.5%	87%	17.2
Zr-BEA	1.7	34.9%	59.1%	6.0%	375	5.2%	86.5%	19.7
Zr-BEA	1.7	38.9%	59.9%	1.2%	425	12.8%	87%	13.9
Zr-BEA	1.7	37.4%	59.6%	3.0%	425	12.4%	85%	33.2
Zr-BEA	1.7	34.9%	59.1%	6.0%	425	12.8%	81%	65.0

Table S2 Reaction rates for 0.1g H-BEA and Zr-BEA under 55 bar at different temperature with different partial pressure of C₂H₄ and 2,5-dimethylfuran

Catalyst	Temperature(°C)	Conversion	Selectivity	Reaction rate (1/(site.h))	$\log(k)$ $(k = \frac{r}{c(C_2H_4)c(DMF)})$
H-BEA	325	8.4%	42%	0.9	4.6
H-BEA	350	11.4%	48%	1.4	5.1
H-BEA	375	16.3%	51%	2.1	5.6
H-BEA	400	18.7%	57%	2.7	5.9
H-BEA	425	25.8%	49%	3.1	6.2
Sn-BEA	350	3.7%	93%	3.03	6.9
Sn-BEA	375	6.9%	92%	5.7	7.6
Sn-BEA	400	11.6%	86%	8.9	8.2
Sn-BEA	425	13.6%	85%	10.3	8.4
Sn-BEA	450	18.2%	85%	13.8	8.7
Zr-BEA	350	4.1%	87%	4.5	6.3
Zr-BEA	375	5.9%	88%	6.4	6.7
Zr-BEA	400	7.6%	88%	8.3	7.1
Zr-BEA	425	12.8%	87%	13.9	7.6
Zr-BEA	450	19.8%	86%	21.4	8.1

Table S3 Reaction results for different temperature at 55 bar, gas flow rate 25ml/min, liquid flow rate 0.1ml/min, 0.1g catalysts (H-BEA, Sn-BEA, Zr-BEA), 2% 2,5-dimethylfuran concentration in heptane