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APPENDICES

Appendix A Ethylene Epoxidation over Alumina- and Silica-Supported Silver Catalysts in Low-Temperature AC Dielectric Barrier Discharge

Table A1 Effect of plasma volume-to-catalyst weight ratio on C_2H_4 and O_2 conversions, and power consumption

Plasma volume-to-catalyst weight ratio (cm^3/g)	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Sole plasma	21.79	91.51	1.42	14.06
0.81	15.16	33.72	1.92	17.10
1.04	18.00	94.92	1.63	14.48
1.55	12.71	59.74	2.57	12.41
2.51	18.18	97.63	1.63	15.88
3.78	22.90	82.06	1.40	18.67

Table A2 Effect of plasma volume-to-catalyst weight ratio on EO yield and selectivities for EO and other products

Plasma volume-to-catalyst weight ratio (cm^3/g)	EO yield (%)	Selectivity* (%)			
		EO	H_2	CO	C_2H_2
Sole plasma	2.20	10.08	79.28	60.98	52.46
0.81	1.70	11.24	29.71	17.84	35.23
1.04	2.02	11.25	58.30	29.93	47.36
1.55	2.63	20.73	82.23	61.70	77.01
2.51	1.86	10.29	57.00	32.91	45.46
3.78	1.72	7.50	47.78	36.76	32.79

* Selectivity based on C_2H_4 conversion

Table A3 Effect of Ag loading on the Al_2O_3 support on C_2H_4 and O_2 conversions, and power consumption

Ag loading (wt.%)	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Sole plasma	21.79	91.51	1.42	14.06
0	25.49	97.68	1.03	17.33
5	12.71	59.74	2.57	12.41
10	9.28	57.69	3.50	14.07
15	10.07	46.69	2.96	15.62
20	9.96	58.03	3.25	15.54

Table A4 Effect of Ag loading on the Al_2O_3 support on EO yield and selectivities for EO and other products

Ag loading (wt.%)	EO yield (%)	Selectivity* (%)			
		EO	H_2	CO	C_2H_2
Sole plasma	2.20	10.08	79.28	60.98	52.46
0	1.52	5.97	91.34	29.89	21.45
5	2.63	20.73	82.23	61.70	77.01
10	2.31	24.9	82.30	72.30	70.66
15	1.91	18.96	83.68	54.69	75.52
20	2.08	20.90	72.64	40.83	67.83

* Selectivity based on C_2H_4 conversion

Table A5 Effect of Ag loading on the SiO_2 support on C_2H_4 and O_2 conversions, and power consumption

Ag loading (wt.%)	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Sole plasma	21.79	91.51	1.42	14.06
0	15.62	94.27	2.30	20.64
5	23.13	98.49	1.31	18.64
10	18.35	95.19	1.58	14.11
15	17.00	62.94	1.91	23.57
20	7.00	64.36	4.66	15.26
25	10.25	42.79	2.16	18.59
30	12.08	37.89	1.79	11.96

Table A6 Effect of Ag loading on the SiO_2 support on EO yield and selectivities for EO and other products

Ag loading (wt.%)	EO yield (%)	Selectivity* (%)			
		EO	H_2	CO	C_2H_2
Sole plasma	2.20	10.08	79.28	60.98	52.46
0	1.74	11.12	73.52	69.66	62.28
5	1.62	7.00	48.01	19.96	38.39
10	2.06	11.23	32.93	24.67	4.30
15	1.33	8.04	4035	19.65	28.64
20	2.10	30.56	61.54	29.62	49.49
25	1.75	17.11	16.64	17.72	48.80
30	1.81	15.00	15.52	12.00	77.53

* Selectivity based on C_2H_4 conversion

Table A7 Comparisons of the ethylene epoxidation performances in terms of C_2H_4 and O_2 conversions, and power consumption under the sole DBD system, the DBD system with the unloaded supports and the DBD system with both supported Ag catalysts

DBD system	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Sole DBD	21.79	91.51	1.42	14.06
With Al_2O_3 support	25.42	97.68	1.03	17.33
With SiO_2 support	15.62	94.22	2.30	20.64
With 10 wt.% Ag/Al_2O_3 support	9.28	57.69	3.50	14.07
With 20 wt.% Ag/SiO_2 support	7.00	64.36	4.66	15.26

Table A8 Comparisons of the ethylene epoxidation performances in terms of EO yield and selectivities for EO and other products under the sole DBD system, the DBD system with the unloaded supports and the DBD system with both supported Ag catalysts

DBD system	EO yield (%)	Selectivity* (%)			
		EO	H_2	CO	C_2H_2
Sole DBD	2.20	10.08	79.28	60.98	52.46
With Al_2O_3 support	1.52	5.97	91.34	29.89	21.45
With SiO_2 support	1.74	11.12	73.52	69.60	62.28
With 10 wt.% Ag/Al_2O_3 support	2.31	24.93	82.30	72.30	70.66
With 20 wt.% Ag/SiO_2 support	2.14	30.56	61.56	29.69	49.49

* Selectivity based on C_2H_4 conversion

Appendix B Ethylene Epoxidation in Cylindrical Dielectric Barrier Discharge: Effects of Separate Ethylene/Oxygen Feed

Table B1 Effect of C_2H_4 feed position on C_2H_4 and O_2 conversions, and power consumption

C_2H_4 feed position	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Mixed feed	10.62	62.62	1.53	6.26
0	10.17	62.93	1.50	6.82
0.25	2.89	60.15	6.32	8.04
0.50	6.82	36.63	2.37	12.40
0.75	4.77	28.83	3.34	-
1	2.11	26.05	7.50	-

Table B2 Effect of C_2H_4 feed position on EO yield, current, and selectivities for EO and other products

C_2H_4 feed position	EO yield (%)	Current (mA)	Selectivity** (%)			
			EO	H_2	CO	C_2H_2
Mixed feed	2.60	0.72	8.94	23.96	24.83	37.96
0	2.32	0.75	12.65	22.84	26.97	34.16
0.25	2.08	0.76	15.06	20.64	31.45	27.94
0.50	1.30	0.77	17.02	20.19	39.05	23.74
0.75	0	0.76	0	0	70.54	25.27
1	0	0.74	0	0	83.68	7.33

** Selectivity based on total mole of product

Table B3 Effect of C_2H_4 feed position on concentration of outlet gas

C_2H_4 feed position	Concentration of outlet gas (mol%)					
	C_2H_4	O_2	EO	H_2	CO	C_2H_2
Mixed feed	14.75	1.61	0.47	1.25	1.30	1.98
0	16.18	1.68	0.42	0.75	0.89	1.13
0.25	17.39	1.73	0.37	0.51	0.78	0.72
0.50	16.68	2.62	0.23	0.28	0.53	0.32
0.75	17.45	3.15	0	0	0.41	0.15
1	17.65	3.25	0	0	0.34	0.04

Table B4 Effect of O_2/C_2H_4 Feed Molar Ratio on C_2H_4 and O_2 conversions, and power consumption

O_2/C_2H_4 Feed Molar Ratio	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
1/5	3.29	58.86	4.78	9.20
1/4	2.89	60.15	6.32	8.04
1/3.33	3.23	78.50	4.77	7.60
1/2.25	2.58	42.82	5.68	9.34
1/2	3.16	60.45	5.49	10.96
1/0.67	8.92	28.91	1.67	9.86

Table B5 Effect of O_2/C_2H_4 Feed Molar Ratio on EO yield and selectivities for EO and other products

O_2/C_2H_4 Feed Molar Ratio	EO yield (%)	Selectivity** (%)			
		EO	H_2	CO	C_2H_2
1/5	1.71	16.11	17.95	29.70	33.68
1/4	2.08	15.06	20.64	31.45	27.94
1/3.33	1.92	11.92	18.32	29.42	36.65
1/2.25	1.57	12.39	18.72	33.37	31.33
1/2	1.55	11.81	17.31	32.68	35.01
1/0.67	1.51	11.86	22.48	38.42	24.16

** Selectivity based on total mole of product

Table B6 Effect of O_2/C_2H_4 Feed Molar Ratio on concentration of outlet gas

O_2/C_2H_4 Feed Molar Ratio	Concentration of outlet gas (mol%)					
	C_2H_4	O_2	EO	H_2	CO	C_2H_2
1/5	14.75	0.04	0.47	1.25	1.30	1.98
1/4	16.18	1.68	0.42	0.75	0.89	1.13
1/3.33	17.39	1.73	0.37	0.51	0.78	0.72
1/2.25	16.68	2.62	0.23	0.25	0.53	0.32
1/2	17.45	3.15	0	0	0.41	0.15
1/0.67	17.65	3.25	0	0	0.34	0.04

Table B7 Effect of applied voltage on C_2H_4 and O_2 conversions, and power consumption

Applied voltage (kV)	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
12	5.12	99.28	2.36	5.60
13	4.60	99.83	3.12	5.03
14	3.34	99.47	3.64	5.36
15	2.89	60.14	6.32	8.04
17	4.81	55.96	3.15	6.68

Table B8 Effect of applied voltage on EO yield, current, and selectivities for EO and other products

Applied voltage (kV)	EO yield (%)	Current (mA)	Selectivity** (%)			
			EO	H_2	CO	C_2H_2
12	4.06	0.720	22.52	28.37	13.45	32.87
13	7.98	0.743	30.57	17.11	12.48	36.09
14	4.56	0.751	22.04	27.88	14.39	32.59
15	2.08	0.764	15.06	20.64	31.45	27.94
17	2.30	0.770	15.96	16.13	29.23	35.35

** Selectivity based on total mole of product

Table B9 Effect of applied voltage on concentration of outlet gas

Applied voltage (kV)	Concentration of outlet gas (mol%)					
	C_2H_4	O_2	EO	H_2	CO	C_2H_2
12	21.89	0.03	.94	1.18	0.56	1.37
13	18.93	0.01	1.58	0.89	0.65	1.87
14	22.52	0.03	1.06	1.35	0.69	1.57
15	17.39	1.73	0.37	0.51	0.78	0.72
17	19.22	1.99	0.46	0.47	0.85	1.03

Table B10 Effect of input frequency on C_2H_4 and O_2 conversions, and power consumption

Input frequency (Hz)	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
450	2.28	45.25	5.63	7.73
500	4.60	99.83	3.12	5.03
550	3.68	74.57	3.49	5.21
600	2.91	29.34	1.95	13.24

Table B11 Effect of input frequency on EO yield, current, and selectivities for EO and other products

Input frequency (Hz)	EO yield (%)	Current (mA)	Selectivity** (%)			
			EO	H_2	CO	C_2H_2
450	1.66	0.758	19.38	24.51	47.82	5.09
500	7.98	0.743	30.57	17.11	12.48	36.09
550	7.47	0.728	33.85	13.35	5.42	42.53
600	0.79	0.687	13.54	16.53	42.63	23.64

** Selectivity based on total mole of product

Table B12 Effect of input frequency on concentration of outlet gas

Input frequency (Hz)	Concentration of outlet gas (mol%)					
	C_2H_4	O_2	EO	H_2	CO	C_2H_2
450	22.28	2.69	0.38	0.48	0.93	0.10
500	18.93	0.01	1.58	0.89	0.65	1.87
550	21.80	1.18	1.69	0.67	0.27	2.12
600	23.52	3.16	0.19	0.23	0.60	0.33

Table B13 Effect of total feed flow rate on C_2H_4 and O_2 conversions, and power consumption

Total feed flow rate (cm^3/min)	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
60	5.59	41.48	2.21	8.69
75	3.68	74.57	3.49	5.21
100	8.05	45.62	1.03	7.13
125	3.12	17.35	2.17	12.29

Table B14 Effect of total feed flow rate on EO yield, current, and selectivities for EO and other products

Total feed flow rate (cm^3/min)	EO yield (%)	Current (mA)	Selectivity** (%)			
			EO	H_2	CO	C_2H_2
60	1.42	0.702	17.67	25.92	34.13	20.23
75	7.47	0.756	33.85	13.35	5.42	42.53
100	1.16	0.718	21.82	0.00	42.15	35.32
125	0.55	0.705	13.68	0.00	25.58	57.65

** Selectivity based on total mole of product

Table B15 Effect of total feed flow rate on concentration of outlet gas

Total feed flow rate (cm^3/min)	Concentration of outlet gas (mol%)					
	C_2H_4	O_2	EO	H_2	CO	C_2H_2
60	24.84	1.30	0.37	0.55	0.72	0.43
75	21.80	1.18	1.69	0.67	0.27	2.12
100	22.16	1.74	0.28	0.00	0.54	0.45
125	23.01	2.91	0.13	0.00	0.24	0.55

Table B16 Comparisons of the cylindrical DBD system performance using the separate C_2H_4/O_2 feed and the mixed C_2H_4/O_2 feed in terms of C_2H_4 and O_2 conversions, and power consumption

DBD system	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Separate feed	3.68	74.57	3.49	5.21
Mixed feed	10.62	62.93	1.50	6.30

Table B17 Comparisons of the cylindrical DBD system performance using the separate C_2H_4/O_2 feed and the mixed C_2H_4/O_2 feed in terms of EO yield and selectivities for EO and other products

DBD system	EO yield (%)	Selectivity** (%)			
		EO	H_2	CO	C_2H_2
Separate feed	7.47	33.85	13.35	5.42	42.52
Mixed feed	2.60	8.90	24.00	24.80	38.00

** Selectivity based on total mole of product

Appendix C Ethylene Epoxidation in a Low-Temperature Corona Discharge System: Effect of Separate Ethylene/Oxygen Feed

Table C1 Effect of C_2H_4 feed position on C_2H_4 and O_2 conversions, EO yield, and power consumption

C_2H_4 feed position	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{16})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
Mixed feed	14.19	39.57	0.63	1.82	40.94
0.1	4.21	29.62	0.46	2.78	25.20
0.2	2.35	25.98	0.68	4.88	16.84
0.3	4.50	26.05	0.64	2.61	18.22
0.4	6.21	31.85	0.46	1.87	25.47
0.5	6.59	27.95	0.48	1.76	23.94
0.7	3.90	26.54	0.40	3.05	29.45

Table C2 Effect of C_2H_4 feed position on selectivities for EO and other products

C_2H_4 feed position	Selectivity** (%)					
	EO	H_2	CO	C_2H_2	C_3H_8	CH_4
Mixed feed	2.95	0	48.15	10.51	2.16	35.84
0.1	2.04	30.26	44.46	15.10	1.79	6.35
0.2	3.83	28.85	42.85	15.47	2.29	6.71
0.3	3.02	28.58	43.57	16.80	2.09	5.94
0.4	2.11	27.51	46.36	15.75	1.97	6.30
0.5	2.38	28.62	43.48	16.79	2.05	6.68
0.7	1.79	29.35	44.96	15.99	1.87	6.04

** Selectivity based on total mole of product

Table C3 Effect of O_2/C_2H_4 feed molar ratio on C_2H_4 and O_2 conversions, EO yield, and power consumption

O_2/C_2H_4 feed molar ratio	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{16})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
0.25:1	3.38	39.04	0.40	3.10	26.31
0.33:1	1.25	20.01	0.51	7.90	19.24
0.5:1	2.35	25.98	0.68	4.88	16.84
0.75:1	4.18	33.91	0.57	2.35	17.39
1:1	3.60	30.69	0.06	3.02	187.15

Table C4 Effect of O_2/C_2H_4 feed molar ratio on selectivities for EO and other products

O_2/C_2H_4 feed molar ratio	Selectivity** (%)					
	EO	H_2	CO	C_2H_2	C_3H_8	CH_4
0.25:1	2.60	27.00	48.85	13.43	1.95	6.16
0.33:1	4.32	28.75	38.89	18.68	2.96	6.40
0.5:1	3.83	28.85	42.85	15.47	2.29	6.71
0.75:1	2.25	18.09	47.85	20.73	2.53	8.55
1:1	0.26	23.71	65.72	4.15	0.47	5.69

** Selectivity based on total mole of product

Table C5 Effect of applied voltage on C_2H_4 and O_2 conversions, EO yield, and power consumption

Applied voltage (kV)	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{16})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
15	2.35	25.98	0.68	4.88	16.84
16	2.43	36.92	1.12	4.34	9.42
17	2.24	39.82	1.34	4.34	7.26
18	2.25	44.33	1.76	4.74	6.07
19	2.00	47.82	0.90	5.10	11.27

Table C6 Effect of applied voltage on current and selectivities for EO and other products

Applied voltage (kV)	Current (mA)	Selectivity** (%)					
		EO	H_2	CO	C_2H_2	C_3H_8	CH_4
15	0.718	3.83	28.85	42.85	15.47	2.29	6.71
16	0.718	6.08	26.17	48.79	11.04	1.28	6.63
17	0.720	6.82	24.31	51.50	10.71	1.28	5.37
18	0.724	8.42	26.63	45.85	10.99	1.33	6.77
19	0.729	4.61	33.28	35.47	16.78	2.62	7.24

** Selectivity based on total mole of product

Table C7 Effect of input frequency on C_2H_4 and O_2 conversions, EO yield, and power consumption

Input frequency (Hz)	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{16})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
400	3.95	60.26	0.83	2.62	12.49
500	2.25	44.33	1.76	4.74	6.07
600	2.03	32.55	1.19	4.69	7.98
700	1.77	22.56	1.06	5.00	8.37

Table C8 Effect of input frequency on current and selectivities for EO and other products

Input frequency (Hz)	Current (mA)	Selectivity** (%)					
		EO	H_2	CO	C_2H_2	C_3H_8	CH_4
400	0.768	3.03	27.11	43.11	14.70	2.26	9.80
500	0.724	8.42	26.63	45.85	10.99	1.33	6.77
600	0.711	7.29	23.25	53.35	9.36	1.04	5.70
700	0.679	6.65	27.31	39.94	18.19	1.80	6.11

** Selectivity based on total mole of product

Table C9 Effect of total feed flow rate on C_2H_4 and O_2 conversions and power consumption

Total feed flow rate (cm^3/min)	Residence time (s)	Conversion (%)		Power consumption (Ws x 10^{16})	
		C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
100	0.077	2.25	44.33	4.74	6.07
125	0.062	1.41	34.04	7.03	18.53
150	0.051	1.70	31.78	5.56	30.74

Table C10 Effect of total feed flow rate on EO yield and selectivities for EO and other products

Total feed flow rate (cm^3/min)	EO yield (%)	Selectivity** (%)					
		EO	H_2	CO	C_2H_2	C_3H_8	CH_4
100	1.76	8.42	26.63	45.85	10.99	1.33	6.77
125	0.54	3.20	31.18	47.02	10.30	1.13	7.17
150	0.31	2.00	28.91	47.89	11.78	2.25	7.17

** Selectivity based on total mole of product

Table C11 Effect of electrode gap distance on C_2H_4 and O_2 conversions and power consumption

Electrode gap distance (cm)	Residence time (s)	Conversion (%)		Power consumption (Ws x 10^{16})	
		C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
0.8	0.062	1.83	42.30	4.92	6.88
0.9	0.069	1.85	48.20	4.85	6.44
1.0	0.077	2.25	44.33	4.74	6.07
1.1	0.085	1.91	41.19	5.18	10.03
1.2	0.092	4.34	54.34	2.14	13.12

Table C12 Effect of electrode gap distance on EO yield, current, and selectivities for EO and other products

Electrode gap distance (cm)	EO yield (%)	Current (mA)	Selectivity** (%)					
			EO	H_2	CO	C_2H_2	C_3H_8	CH_4
0.8	1.31	0.728	9.19	30.16	37.23	13.26	3.03	7.13
0.9	1.39	0.726	8.41	27.57	47.88	7.38	1.26	7.50
1.0	1.76	0.724	8.42	26.63	45.85	10.99	1.33	6.77
1.1	0.99	0.723	4.90	28.09	56.63	1.40	1.08	7.90
1.2	0.71	0.721	3.36	26.97	54.34	8.18	0.90	6.26

** Selectivity based on total mole of product

Table C13 Comparisons of the corona discharge performance using the separate and the mixed C_2H_4/O_2 feed in terms of C_2H_4 and O_2 conversions, and power consumption

DBD system	Conversion (%)		Power consumption (Ws x 10^{16})	
	C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
Mixed feed	14.19	39.54	1.82	40.94
Separate feed	2.25	44.33	4.74	6.07

Table C14 Comparisons of the corona discharge performance using the separate and the mixed C_2H_4/O_2 feed in terms of EO yield and selectivities for EO and other products

DBD system	EO yield (%)	Selectivity** (%)				
		EO	CO	C_2H_2	CH_4	C_3H_8
Mixed feed	0.63	2.95	48.15	10.51	35.84	2.16
Separate feed	1.76	8.42	45.85	10.99	6.77	1.33

** Selectivity based on total mole of product

Appendix D Ethylene Epoxidation in an AC Dielectric Barrier Discharge Jet System

Table D1 Effect of total feed flow rate on C_2H_4 and O_2 conversions and power consumption

Total feed flow rate (cm^3/min)	Residence time (s x 100)	Conversion (%)		Power consumption (Ws x 10^{21})	
		C_2H_4	O_2	per molecule of C_2H_4 converted	per molecule of EO produced
1,625	2.29	41.04	75.14	3.77	11.36
1,896	1.96	33.30	70.15	4.52	16.08
2,167	1.72	35.00	56.69	4.75	15.07
2,438	1.53	37.56	55.33	4.55	16.73
2,708	1.37	38.09	48.83	5.43	20.97
3,250	1.14	38.91	48.14	5.94	25.73

Table D2 Effect of total feed flow rate on EO yield and selectivities for EO and other products

Total feed flow rate (cm^3/min)	EO yield (%)	Selectivity* (%)				
		EO	H_2	CO	CH_4	C_2H_6
1,625	13.63	33.22	34.81	3.87	0.52	0.02
1,896	11.10	33.32	29.29	3.74	2.47	0.08
2,167	11.03	31.50	27.33	4.52	2.79	0.14
2,438	10.21	27.19	22.99	3.64	0.20	0.09
2,708	9.86	25.90	18.21	5.13	2.06	0.10
3,250	8.98	23.08	13.93	10.66	0.26	0.11

* Selectivity based on C_2H_4 conversion

Table D3 Effect of total feed flow rate on current and coke and water formations

Total feed flow rate (cm^3/min)	Current (mA)	Formation (%)	
		Coke	Water
1,625	0.523	25.57	12.66
1,896	0.532	20.10	10.75
2,167	0.521	21.37	12.38
2,438	0.521	25.87	18.51
2,708	0.520	25.45	19.66
3,250	0.511	25.63	24.24

Table D4 Effect of O_2/C_2H_4 feed molar ratio on C_2H_4 and O_2 conversions, EO yield, and power consumption

O_2/C_2H_4 feed molar ratio	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{21})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
0.20:1	29.39	67.32	7.62	8.80	33.96
0.25:1	41.04	75.14	13.63	6.07	18.29
0.30:1	47.30	73.54	7.85	6.51	39.24
0.40:1	42.18	81.42	5.39	5.35	41.85
0.50:1	44.23	87.66	6.77	4.36	28.45

Table D5 Effect of O_2/C_2H_4 feed molar ratio on selectivities for EO and other products

O_2/C_2H_4 feed molar ratio	Selectivity* (%)				
	EO	H_2	CO	CH_4	C_2H_6
0.20:1	25.91	44.22	2.08	0.96	0.05
0.25:1	33.22	34.81	3.87	0.52	0.02
0.30:1	16.60	27.09	5.32	0.28	0.02
0.40:1	12.79	29.59	9.53	0.09	0.03
0.50:1	15.32	51.90	34.13	0.00	0.02

* Selectivity based on C_2H_4 conversion

Table D6 Effect of O_2/C_2H_4 feed molar ratio on current and coke and water formations

O_2/C_2H_4 feed molar ratio	Current (mA)	Formation (%)	
		Coke	Water
0.20:1	0.520	20.86	8.18
0.25:1	0.523	25.57	12.66
0.30:1	0.530	36.79	26.35
0.40:1	0.511	32.71	24.20
0.50:1	0.518	22.35	14.49

Table D7 Effect of applied voltage on C_2H_4 and O_2 conversions, EO yield, and power consumption

Applied voltage (kV)	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{21})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
7	41.04	75.14	13.63	6.18	18.61
8	45.99	73.93	17.71	5.13	13.31
9	44.83	75.41	18.41	5.15	12.55
10	43.98	76.04	14.87	6.37	18.85
11	47.76	80.48	11.91	5.93	23.76
13	46.56	82.52	11.52	6.50	26.26
15	44.53	85.13	7.94	7.22	40.51

Table D8 Effect of applied voltage on selectivities for EO and other products

Applied voltage (kV)	Selectivity* (%)				
	EO	H_2	CO	CH_4	C_2H_6
7	33.22	34.81	3.87	0.52	0.02
8	38.51	34.85	4.67	0.51	0.01
9	41.06	39.09	5.48	0.47	0.02
10	33.81	44.72	6.67	0.52	0.02
11	24.95	44.10	7.03	0.50	0.01
13	24.74	48.14	7.95	0.51	0.03
15	17.83	59.08	9.04	0.42	0.02

* Selectivity based on C_2H_4 conversion

Table D9 Effect of applied voltage on power, current, and coke and water formations

Applied voltage (kV)	Power (W)	Current (mA)	Formation (%)	
			Coke	Water
7	0.074	0.523	25.57	12.66
8	0.082	0.643	25.88	11.76
9	0.081	0.676	23.73	8.45
10	0.091	0.750	25.94	8.97
11	0.101	0.825	32.23	14.29
13	0.111	0.978	31.09	12.13
15	0.117	1.100	32.36	9.89

Table D10 Effect of input frequency on C_2H_4 and O_2 conversions, EO yield, and power consumption

Input frequency (Hz)	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{21})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
300	42.01	93.12	19.20	0.817	1.788
400	42.01	78.92	17.23	2.544	6.204
500	44.83	75.41	18.41	5.153	12.550
600	41.58	62.86	12.44	17.093	57.138
700	43.85	66.90	11.29	26.892	104.446
800	42.36	64.30	9.54	30.695	136.320
900	46.06	56.76	7.64	36.978	222.783

Table D11 Effect of input frequency on selectivities for EO and other products

Input frequency (Hz)	Selectivity* (%)				
	EO	H_2	CO	CH_4	C_2H_6
300	45.71	8.75	1.66	0.14	0.04
400	41.00	16.89	2.55	0.19	0.02
500	41.06	39.09	5.48	0.47	0.02
600	29.92	47.04	6.40	0.51	0.03
700	25.75	51.19	10.29	0.49	0.02
800	22.52	52.08	10.31	0.47	0.01
900	16.60	57.36	8.16	0.52	0.01

* Selectivity based on C_2H_4 conversion

Table D12 Effect of input frequency on power, current, and coke and water formations

Input frequency (Hz)	Power (W)	Current (mA)	Formation (%)	
			Coke	Water
300	0.012	0.447	22.03	18.99
400	0.034	0.566	23.63	17.52
500	0.081	0.676	23.73	8.45
600	0.263	0.798	26.25	9.14
700	0.304	0.938	27.82	9.66
800	0.383	1.070	28.25	10.36
900	0.593	1.170	34.41	11.51

Table D13 Effect of Spacing of inner pin electrode and C_2H_4 feed point on C_2H_4 and O_2 conversions, EO yield, and power consumption

Spacing (mm)	Conversion (%)		EO yield (%)	Power consumption (Ws x 10^{21})	
	C_2H_4	O_2		per molecule of C_2H_4 converted	per molecule of EO produced
0	42.01	93.12	19.20	2.96	6.47
3	49.95	91.23	27.57	3.33	6.03
6	21.99	93.49	7.30	10.47	31.53

Table D14 Effect of Spacing of inner pin electrode and C_2H_4 feed point on selectivities for EO and other products

Spacing (mm)	Selectivity* (%)				
	EO	H_2	CO	CH_4	C_2H_6
0	45.71	8.75	1.66	0.14	0.04
3	55.19	4.04	0.66	0.07	0.01
6	33.20	2.77	0.43	0.07	0.06

* Selectivity based on C_2H_4 conversion

Table D15 Effect of Spacing of inner pin electrode and C_2H_4 feed point on power, current, and coke and water formations

Spacing (mm)	Power (W)	Current (mA)	Formation (%)	
			Coke	Water
0	0.0424	0.447	22.03	18.99
3	0.0438	0.441	22.01	20.28
6	0.0471	0.441	14.56	14.03

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