

Every data will be calibrated by mass balance, oxygen balance and carbon balance. These were recorded in primary sheet. Most of those balances are kept between 97.0%-103.0% except for a few eccentric data.

primary data

Table S1

preparation		Argon arc welder						
date		13.10.12	13.10.13	13.10.14	13.10.15	13.10.16	13.10.17	13.10.18
density		2.55	2.55	2.55	2.55	2.55	2.55	2.55
size	mesh	60-80	60-80	60-80	60-80	60-80	60-80	60-80
charge	ml	2	2	2	2	2	2	2
TOS	h	12	36	60	84	108	132	156
Temperature	°C	229.4	229.2	240	239.9	251	251.1	261.3
P	MPa	1.95	1.95	1.95	1.95	1.95	1.95	1.95
GHSV	h-1	3005.75	3005.75	3005.75	3005.75	3005.75	3005.75	3005.75
H2/CO		2.41	2.41	2.41	2.41	2.41	2.41	2.47
CO+H2 conv	%	34.05	33.62	42.46	40.27	50.81	50.95	58.64
CHn Prod	mg/ml/h	149.58	174.25	260.21	253.88	335.81	291.52	341.55
H2O sel	%	16.68	17.75	14.60	15.11	13.64	15.69	19.96
CO2 sel	%	57.31	54.26	55.58	53.40	54.35	54.29	48.89
CH4	wt%	8.07	7.00	7.32	7.18	8.71	9.15	10.25
C5+	wt%	56.48	60.94	59.02	60.38	58.16	56.25	53.28
C5-11	wt%	40.45	46.37	46.10	48.02	46.17	43.96	41.02
C12-18	wt%	13.54	12.31	10.91	10.43	8.85	9.08	9.06
C19+	wt%	2.49	2.27	2.01	1.93	3.13	3.21	3.20
C2-4 O/P		2.42	2.47	2.52	2.47	2.40	2.39	2.35
used H2/CO		1.00	1.06	0.93	0.87	1.00	1.00	1.13
Mass balance	%	95.52	98.68	101.55	98.11	104.37	98.20	100.84
Carbon balance	%	99.61	96.38	100.86	97.90	103.70	97.44	99.46
Oxygen balance	%	95.95	100.61	102.11	97.00	102.51	98.93	102.03

Table S2

preparation	Oxyacetylene torch							
date	13.10.12	13.10.13	13.10.14	13.10.15	13.10.16	13.10.17	13.10.18	13.10.19
density	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63
size	60-80	60-80	60-80	60-80	60-80	60-80	60-80	60-80
charge	2	2	2	2	2	2	2	2
TOS	12	36	60	84	108	132	156	180
T	236.3	236.3	250.5	250.4	259.9	259.8	270.6	270.5
P	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
GHSV	3004.92	3004.92	3004.92	3004.92	3004.92	3004.92	3004.92	3004.92
H2/CO	2.41	2.41	2.41	2.41	2.41	2.41	2.47	2.47
CO+H2 conv	35.23	35.40	49.33	47.48	57.40	53.81	60.95	61.45
CHn Prod	172.37	199.21	276.74	264.16	311.77	301.87	350.73	341.30
H2O sel	22.44	23.15	19.64	21.42	20.01	19.86	20.18	18.97
CO2 sel	48.35	44.96	49.05	46.96	47.94	49.02	48.28	49.54
CH4	11.24	9.84	12.01	12.24	13.96	13.64	15.67	15.79
C5+	48.57	54.79	49.52	48.82	42.39	42.88	38.81	38.08
C5-11	38.81	42.99	39.32	39.00	31.74	32.59	29.80	30.50
C12-18	8.49	10.25	8.32	8.00	7.09	6.84	6.41	5.38
C19+	1.28	1.54	1.88	1.81	3.56	3.44	2.60	2.19
C2-4 O/P	1.63	1.63	1.20	1.20	1.00	1.04	0.90	0.92
used H2/CO	1.23	1.27	1.11	1.07	1.20	1.12	1.26	1.30

Mass balance	97.40	100.54	97.56	95.56	95.92	98.00	103.21	101.78
Carbon balance	95.96	100.11	96.78	95.84	95.33	96.50	103.52	102.93
Oxygen balance	99.49	101.40	97.67	95.52	96.00	98.87	103.91	102.47

Table S3

preparation	Induction furnace							
date	13.6.5	13.6.6	13.6.7	13.6.8	13.6.9	13.6.10	13.6.13	13.6.14
density	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04
size	60-80	60-80	60-80	60-80	60-80	60-80	60-80	60-80
charge	2	2	2	2	2	2	2	2
TOS	72	96	120	144	168	192	216	240
T	230.6	230.6	230.4	239.9	239.6	249.2	249.5	259.2
P	2.05	2.05	2.05	2.05	2.05	2.05	2	2
GHSV	2998.26	2998.26	2998.26	2998.26	2998.26	2998.26	2998.26	2998.26
H2/CO	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
CO+H2 conv	14.57	14.97	13.63	17.07	16.85	18.07	21.01	27.39
CHn Prod	76.25	70.95	80.92	94.38	94.64	129.20	112.15	146.70
H2O sel	41.57	44.43	39.93	39.54	44.27	38.41	38.08	36.24
CO2 sel	18.61	15.02	14.03	16.30	12.52	17.16	20.75	23.41
CH4	17.50	18.75	17.48	21.40	21.35	21.88	17.89	19.16
C5+	29.34	25.79	32.90	24.40	22.93	21.40	24.94	23.78
C5-11	29.06	25.62	32.56	24.22	22.79	21.33	24.77	21.42
C12-18	0.24	0.15	0.30	0.15	0.12	0.06	0.15	0.44
C19+	0.03	0.02	0.04	0.02	0.01	0.01	0.02	1.93
C2-4 O/P	0.41	0.39	0.39	0.32	0.33	0.30	0.34	0.34
used H2/CO	1.29	1.54	1.38	1.35	1.41	1.24	1.75	1.92
Mass balance	96.20	96.03	96.85	95.37	96.46	98.96	98.00	99.32
Carbon balance	95.80	95.93	97.02	95.13	95.59	99.52	98.33	100.32
Oxygen balance	95.90	96.00	95.51	95.92	95.50	96.55	97.38	98.84

preparation	Induction furnace							
date	13.6.15	13.6.16	13.6.17	13.6.18	13.6.19	13.6.20	13.6.21	13.6.22
density	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04
size	60-80	60-80	60-80	60-80	60-80	60-80	60-80	60-80
charge	2	2	2	2	2	2	2	2
TOS	264	288	312	336	360	384	408	432
T	259.3	259.5	269.2	269	279.5	279.3	289.9	289.9
P	2	2	2	2	2	2	1.94	1.94
GHSV	2998.26	2998.26	2998.26	2998.26	2998.26	2998.26	2998.26	2998.26
H2/CO	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.34
CO+H2 conv	23.96	26.06	30.52	29.38	33.77	31.72	38.12	38.49
CHn Prod	143.51	137.96	179.23	166.55	205.58	208.33	237.54	232.09
H2O sel	35.24	35.66	32.24	35.27	32.07	31.62	31.45	28.09
CO2 sel	24.23	22.86	25.22	23.40	26.24	23.69	26.59	34.37
CH4	19.74	20.31	19.95	21.69	23.75	24.67	27.06	27.61
C5+	22.84	22.06	26.61	20.66	18.85	18.83	16.23	15.26
C5-11	20.12	19.80	22.94	17.67	16.04	15.29	13.35	12.85
C12-18	0.50	0.43	0.64	0.53	0.51	0.60	0.50	0.42
C19+	2.23	1.84	3.03	2.46	2.30	2.93	2.38	1.99
C2-4 O/P	0.37	0.39	0.39	0.43	0.46	0.50	0.53	0.54
used H2/CO	1.76	1.89	1.74	1.73	1.61	1.55	1.59	1.64
Mass balance	100.90	98.15	98.84	98.59	99.23	98.87	99.52	102.98
Carbon balance	102.01	99.55	101.70	99.96	101.77	102.74	102.61	103.10
Oxygen balance	100.03	97.28	96.55	97.21	96.63	97.72	96.20	101.83

preparation	Induction furnace				
date	13.6.23	13.6.24	13.6.25	13.6.27	13.6.28
density	2.04	2.04	2.04	2.04	2.04
size	60-80	60-80	60-80	60-80	60-80
charge	2	2	2	2	2
TOS	456	480	504	552	576
T	299.9	299.9	310.5	310.3	320.5
P	1.94	1.94	1.94	1.94	1.94
GHSV	2998.26	2998.26	2998.26	2998.26	2998.26
H2/CO	2.34	2.34	2.34	2.34	2.34
CO+H2 conv	43.29	42.04	48.86	49.79	59.36
CHn Prod	247.63	250.38	276.61	296.24	334.64
H2O sel	26.95	26.76	26.53	25.49	24.78
CO2 sel	35.17	34.42	35.07	35.48	36.08
CH4	30.22	30.89	32.14	32.02	30.87
C5+	13.96	14.22	10.88	11.85	11.56
C5-11	11.70	11.22	9.15	9.91	9.21
C12-18	0.40	0.52	0.30	0.35	0.42
C19+	1.86	2.48	1.43	1.59	1.93
C2-4 O/P	0.55	0.56	0.59	0.64	0.68
used H2/CO	1.69	1.71	1.72	1.60	1.61
Mass balance	100.86	101.89	100.21	99.78	96.34
Carbon balance	103.58	104.31	103.90	103.99	101.44
Oxygen balance	99.37	99.86	98.13	96.50	96.28

The catalyst prepared by Argon arc welder method were evaluated twice for repeatable. See table S4-S5

repeat experiment

run 1

Table S4

preparation		Argon arc welder						
date		2013.10.12	2013.10.13	2013.10.14	2013.10.15	2013.10.16	2013.10.17	2013.10.18
density		2.55	2.55	2.55	2.55	2.55	2.55	2.55
size	mesh	60-80	60-80	60-80	60-80	60-80	60-80	60-80
charge	ml	2	2	2	2	2	2	2
TOS	h	12	36	60	84	108	132	156
Temperature	°C	229.4	229.2	240	239.9	251	251.1	261.3
P	MPa	1.95	1.95	1.95	1.95	1.95	1.95	1.95
GHSV	h-1	3006	3006	3006	3006	3006	3006	3006
H2/CO		2.41	2.41	2.41	2.41	2.41	2.41	2.47
CO+H2 conv	%	34.05	33.62	42.46	40.27	50.81	50.95	58.64
CHn Prod	mg/ml/h	149.58	174.25	260.21	253.88	335.81	291.52	341.55
H2O sel	%	16.68	17.75	14.60	15.11	13.64	15.69	19.96
CO2 sel	%	57.31	54.26	55.58	53.40	54.35	54.29	48.89
CH4	wt%	8.07	7.00	7.32	7.18	8.71	9.15	10.25
C5+	wt%	56.48	60.94	59.02	60.38	58.16	56.25	53.28
C5-11	wt%	40.45	46.37	46.10	48.02	46.17	43.96	41.02
C12-18	wt%	13.54	12.31	10.91	10.43	8.85	9.08	9.06
C19+	wt%	2.49	2.27	2.01	1.93	3.13	3.21	3.20
C2-4 O/P		2.42	2.47	2.52	2.47	2.40	2.39	2.35
used H2/CO		1.00	1.06	0.93	0.87	1.00	1.00	1.13
M bal	%	95.52	98.68	101.55	98.11	104.37	98.20	100.84

C bal	%	93.61	96.38	100.86	97.90	104.70	97.44	99.46
O bal	%	95.95	100.61	102.11	97.00	102.51	98.93	102.03

run 2

Table S5

preparation	Argon arc welder							
	2014.3.23	2014.3.24	2014.3.26	2014.3.27	2014.3.28	2014.3.29	2014.3.30	2014.3.31
density	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
size	60-80	60-80	60-80	60-80	60-80	60-80	60-80	60-80
charge	2	2	2	2	2	2	2	2
TOS	12	36	84	108	132	156	180	204
T	220.6	220.7	230.7	230.6	240.4	240.4	250.3	260
P	2	2	2	2	2	2	2	2
GHSV	2948	2948	2948	2948	2948	2948	2948	2948
H2/CO	2.51	2.51	2.41	2.41	2.41	2.41	2.41	2.41
CO+H2 conv	23.09	24.02	33.84	35.01	44.01	45.15	48.28	57.79
CHn Prod	111.62	135.86	210.81	212.78	212.70	267.24	276.61	323.74
H2O sel	17.53	17.17	16.95	17.58	18.60	14.87	15.89	16.79
CO2 sel	46.38	45.11	51.26	49.87	57.30	56.34	53.73	52.60
CH4	6.24	5.66	5.76	5.83	10.27	8.96	8.77	11.33
C5+	61.75	63.66	65.51	66.18	50.72	57.22	58.10	50.68
C5-11	48.16	48.84	44.27	43.07	35.36	37.18	38.02	33.70
C12-18	7.85	8.58	12.22	13.28	8.83	11.49	11.52	9.76
C19+	5.73	6.24	9.02	9.84	6.52	8.55	8.56	7.23
C2-4 O/P	2.30	2.35	2.33	2.27	2.06	1.94	1.85	1.57
used H2/CO	1.48	1.45	1.07	1.11	0.99	0.99	1.08	1.12
M bal	95.77	98.07	102.45	100.85	102.25	104.31	101.16	100.20
C bal	97.85	101.30	103.01	101.60	96.12	103.01	100.98	99.87
O bal	94.82	96.44	102.46	100.53	103.93	105.07	101.93	101.02