

APPENDIX B

FIXED BED REACTION DATA

Co.025 - Run #X

Co wt%	NM wt %	Promotor wt%		Support
20		Zr 8.50		SiO ₂

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.200 g
 WHSV = 12.86 1/hr
 time on stream = 23.5 hrs

CO₂ (% of CO) =
 O/P = 0
 0.00

CO conversion (%)	2.0
rate (g CH ₂ /g cat/hr)	0.11
alpha	0.61
C1 (wt%)	26.8
C2 - C4 (wt%)	29.7
C5 - C12 (wt%)	41.1
C13 + (wt%)	2.4

Performance of Co.025

Dates: 05/26/95 - 01/00/00 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	2.5	5.5	8.5	11.5	14.5	17.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	30.91	26.33	27.04	32.13	28.69	29.06
C2	7.54	6.25	6.28	7.34	6.51	6.55
C3	16.68	13.41	13.25	1.16	13.20	13.14
C4	16.59	13.32	12.97	14.60	12.74	12.64
C5	15.96	12.80	12.37	13.72	12.04	11.87
C6	12.31	8.91	9.51	10.37	8.89	8.99
C7	0.00	6.40	6.24	6.98	6.11	5.95
C8	0.00	4.24	4.14	4.64	3.99	4.02
C9	0.00	2.83	2.78	3.03	2.68	2.71
C10	0.00	1.97	1.98	2.18	1.88	1.76
C11	0.00	1.17	1.14	1.24	1.10	1.15
C12	0.00	0.78	0.75	0.89	0.72	0.66
C13	0.00	0.58	0.53	0.53	0.47	0.46
C14	0.00	0.48	0.43	0.46	0.37	0.42
C15	0.00	0.34	0.35	0.42	0.34	0.33
alpha chain growth probability	1.00	0.60	0.60	0.60	0.59	0.60

C1 - C50 estimated total product distribution, weight %

C1	0.0	26.0	26.8	31.8	28.5	28.8
C2 - C4	0.0	32.5	32.2	22.9	32.2	32.0
C5 - C12	1.9	39.5	39.2	43.3	37.7	37.5
C13 - C50	98.0	2.1	1.8	2.0	1.6	1.8

CO conversion, %	2758.2	2.6	2.5	2.1	2.3	2.2
rate, g CH ₂ /g cat/hr	155.15	0.14	0.14	0.12	0.13	0.13
CO ₂ formation, %						

Performance of Co.025

Dates: 05/26/95 - 01/00/00 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	20.5	23.5	26.5	29.5	32.5	35.5
reaction temperature, °C	220	220	220	220	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	29.00	26.98	30.47	30.26	61.53	42.84
C2	6.53	6.18	6.98	6.92	9.66	9.80
C3	13.11	11.81	12.94	12.85	14.80	11.72
C4	12.63	11.88	12.07	11.83	7.10	6.24
C5	11.84	11.84	11.12	11.06	3.74	3.88
C6	9.14	9.20	8.70	8.67	0.35	0.51
C7	5.85	6.53	5.65	5.69	0.89	7.62
C8	3.95	4.70	3.73	3.81	0.56	5.01
C9	2.62	3.33	2.51	2.82	0.38	3.45
C10	1.84	2.54	1.77	1.75	0.24	2.46
C11	1.13	1.83	1.20	1.32	0.17	1.64
C12	0.63	1.24	0.81	0.90	0.11	1.37
C13	0.54	0.83	0.67	0.69	0.12	0.08
C14	0.34	0.55	0.62	0.60	0.10	1.04
C15	0.32	0.33	0.48	0.50	0.14	1.26
alpha chain growth probability	0.59	0.61	0.62	0.62	0.54	0.67

C1 - C50 estimated total product distribution, weight %

C1	29.0	26.8	29.8	29.8	61.2	41.5
C2 - C4	32.2	29.7	31.3	31.1	31.4	26.9
C5 - C12	37.4	41.1	36.1	36.5	6.9	26.7
C13 - C50	1.4	2.4	2.7	2.6	0.4	4.9

CO conversion, %	2.1	2.0	1.5	1.6	6.1	3.9
rate, g CH ₂ /g cat/hr	0.12	0.11	0.09	0.09	0.34	0.22
CO ₂ formation, %						

Performance of Co.025
 Dates: 05/26/95 - 01/00/00 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	38.5	41.5	44.5	48.8	51.8	54.8
reaction temperature, °C	280	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	50.10	46.05	54.33	45.49	45.35	47.32
C2	13.60	13.78	17.39	15.16	15.65	16.53
C3	14.30	13.30	15.73	13.10	13.06	1.36
C4	8.00	7.67	9.04	7.71	7.59	8.14
C5	5.43	5.39	0.52	5.47	5.62	6.29
C6	1.32	3.32	1.83	1.25	1.32	1.31
C7	1.98	2.19	0.22	2.26	2.66	3.13
C8	1.33	1.48	0.15	1.84	1.86	2.23
C9	0.93	1.04	0.11	1.21	1.29	1.67
C10	0.68	0.82	0.09	1.02	1.27	1.35
C11	0.49	0.67	0.06	0.75	0.79	1.07
C12	0.45	0.58	0.05	0.58	0.63	0.85
C13	0.32	0.02	0.04	0.47	0.56	0.71
C14	0.33	0.45	0.05	0.44	0.60	0.67
C15	0.32	0.43	0.05	0.52	0.70	0.75
alpha chain growth probability	0.60	0.62	0.51	0.70	0.64	0.66

C1 - C50 estimated total product distribution, weight %

C1	49.6	46.3	54.3	46.1	44.7	49.5
C2 - C4	35.5	34.9	42.1	36.5	35.8	27.2
C5 - C12	13.5	16.8	3.4	15.0	16.8	20.0
C13 - C50	1.4	2.0	0.2	2.4	2.7	3.3

CO conversion, %	2.0	1.6	1.1	1.0	0.9	0.7
rate, g CH ₂ /g cat/hr	0.11	0.09	0.06	0.06	0.05	0.04
CO ₂ formation, %						

Performance of Co.025
 Dates: 05/26/95 - 01/00/00 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	57.8	60.8	63.8	66.8	69.8	0.0
reaction temperature, °C	220	220	220	220	220	0
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	90.0	90.0	90.0	0.0

C1 - C15 product distribution, weight %

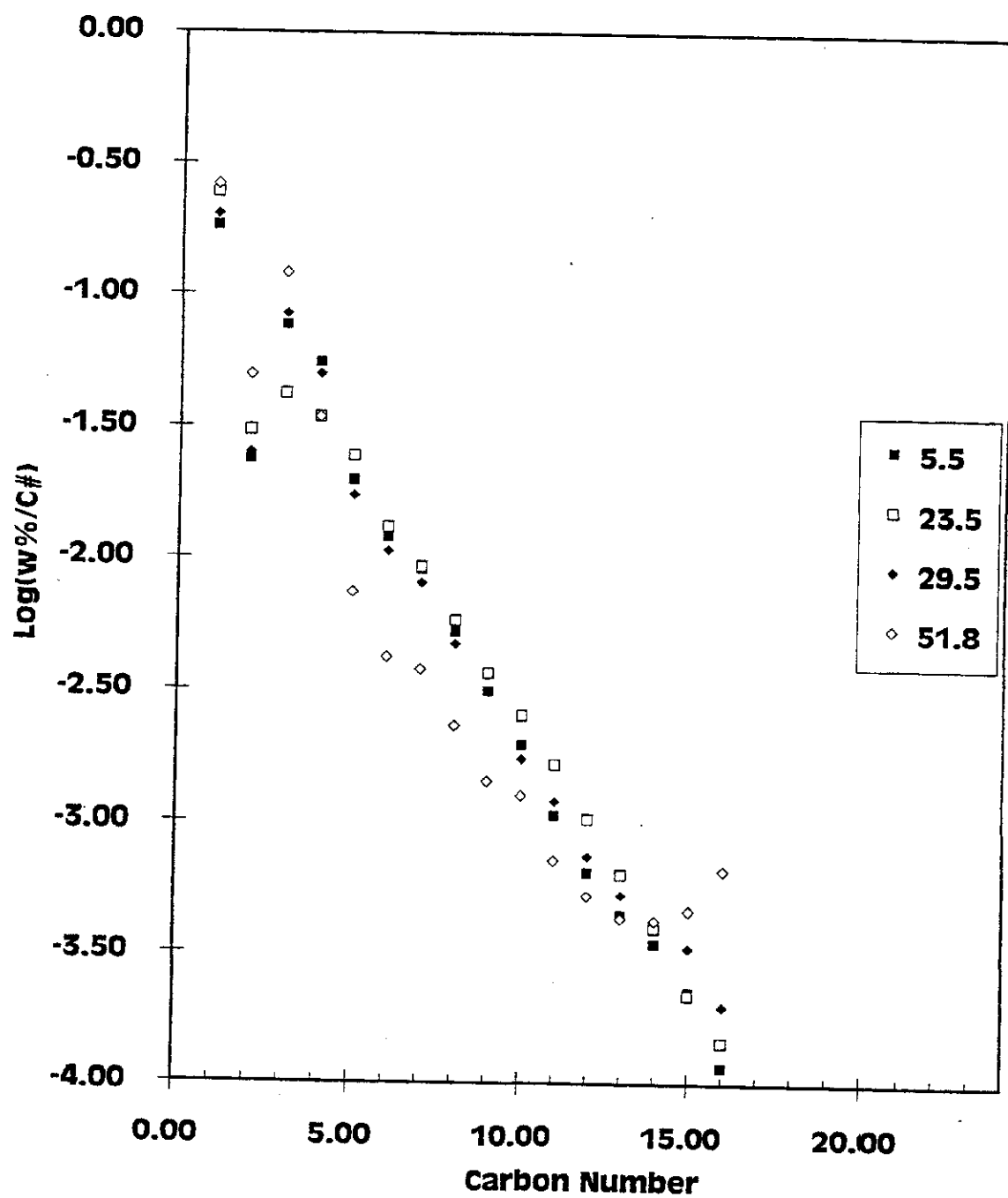
C1	26.12	30.14	29.39	30.26	31.79	0.00
C2	9.68	11.15	6.02	6.05	6.22	0.00
C3	8.32	9.61	13.04	13.05	13.34	0.00
C4	7.35	8.67	12.67	12.66	12.62	0.00
C5	7.28	8.42	11.54	11.38	11.45	0.00
C6	4.82	1.13	8.57	8.55	8.26	0.00
C7	5.00	5.80	5.33	5.21	5.11	0.00
C8	4.06	4.66	3.61	3.40	3.30	0.00
C9	3.55	4.10	2.38	2.24	2.18	0.00
C10	2.92	3.18	1.89	1.57	1.43	0.00
C11	2.71	3.33	1.20	0.97	1.24	0.00
C12	2.54	2.55	0.63	0.67	0.59	0.00
C13	1.88	1.84	0.54	0.47	0.43	0.00
C14	1.69	1.64	0.48	0.39	0.35	0.00
C15	1.71	1.73	0.51	0.39	0.35	0.00
alpha chain growth probability	0.73	0.79	0.60	0.62	0.59	0.00

C1 - C50 estimated total product distribution, weight %

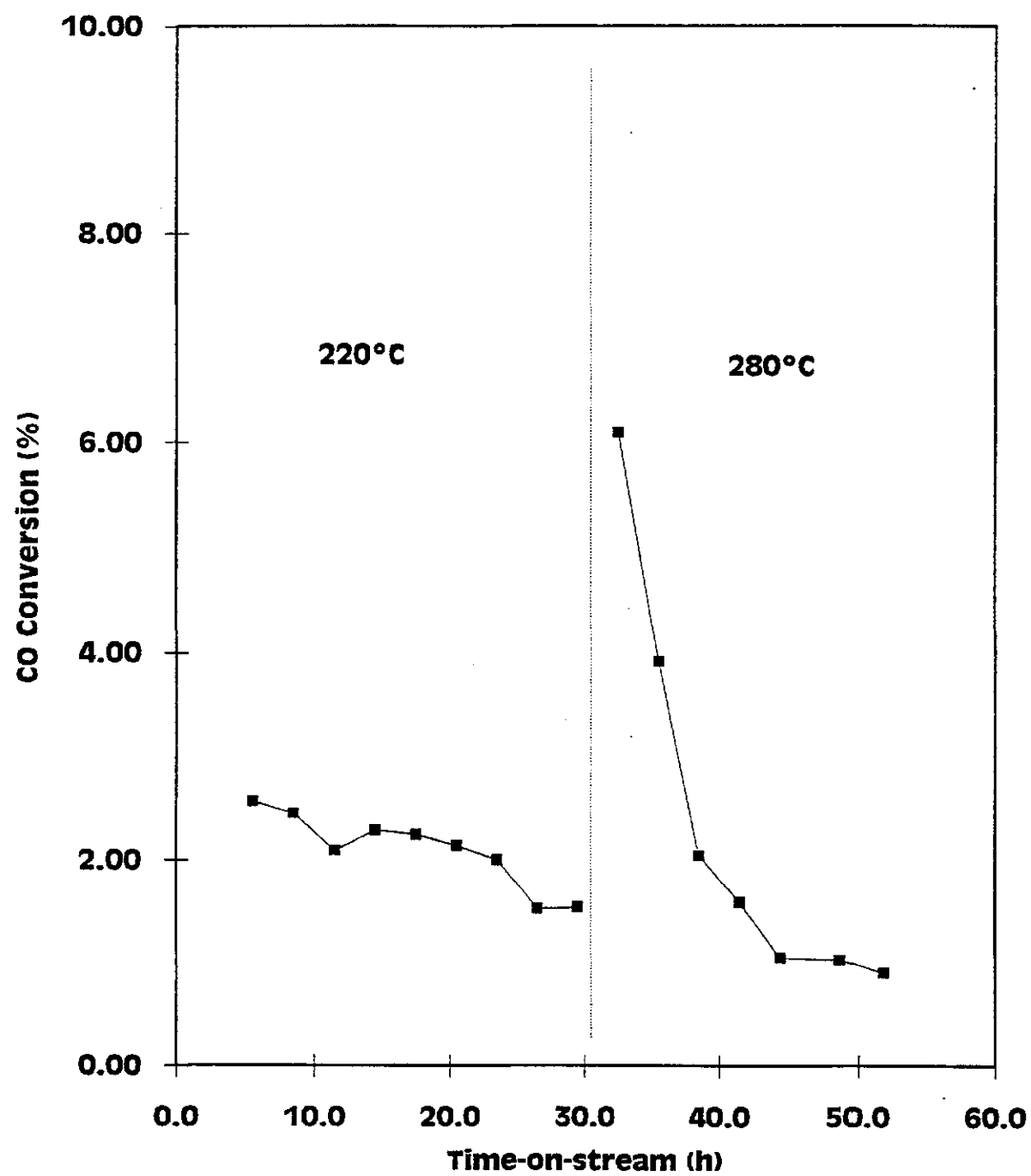
C1	27.5	27.9	29.6	30.8	32.0	0.0
C2 - C4	26.7	27.2	31.9	32.3	32.4	0.0
C5 - C12	35.7	31.0	36.4	35.1	34.2	0.0
C13 - C50	10.0	13.9	2.1	1.8	1.5	0.0

CO conversion, %	0.3	0.3	2.2	2.1	2.1	0.0
rate, g CH ₂ /g cat/hr	0.02	0.02	0.12	0.12	0.12	0.00
CO ₂ formation, %						

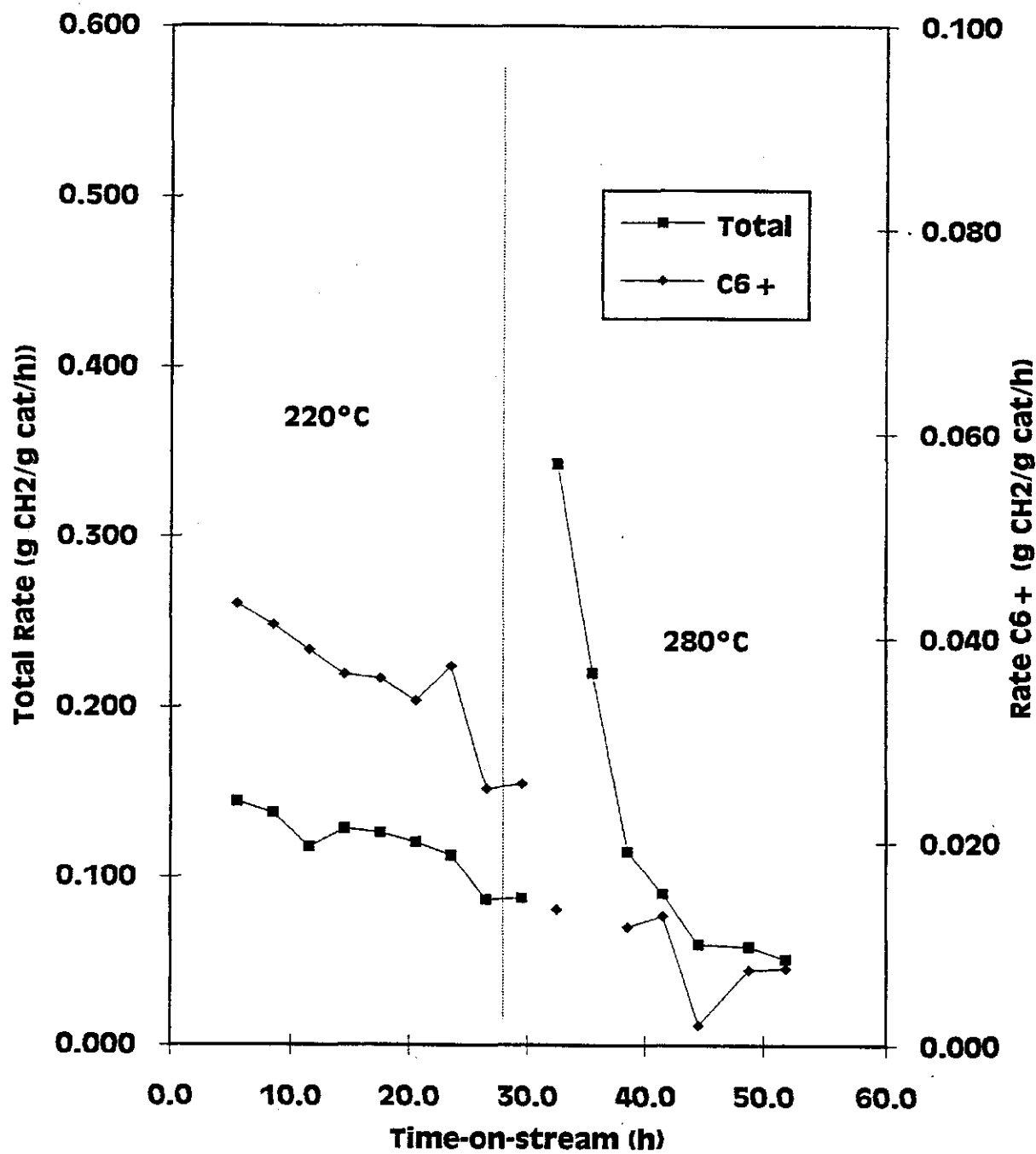
CO Hydrogenation on Co.025 - ASF Product Distribution



CO Hydrogenation on Co.025



CO Hydrogenation on Co.025



Co.053 - Run #12

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.50			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.210 g
 WHSV = 12.24 1/hr
 time on stream = 3.5 hrs

CO₂ (g/g cat/hr) = 0.029
 CO₂ (% of CO) = 0.2
 O/P = 0.98

CO conversion (%)	8.1
rate (g CH ₂ /g cat/hr)	0.43
alpha	0.60
C1 (wt%)	26.6
C2 - C4 (wt%)	29.2
C5 - C12 (wt%)	42.9
C13 + (wt%)	1.3

Performance of Co.053

Dates: 03/23/95 - 03/24/95 Run #12

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.2 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	0.5	3.5	18.5	21.5	24.5	30.5
reaction temperature, °C	220	220	220	220	220	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	26.33	26.22	25.93	27.04	26.95	61.30
C2	5.02	4.51	4.32	4.48	4.74	8.61
C3	12.10	11.86	10.84	11.41	11.33	12.82
C4	12.27	12.38	11.02	11.59	11.62	7.57
C5	11.46	11.86	10.49	11.27	11.10	4.11
C6	8.89	9.29	8.80	8.85	8.83	1.90
C7	7.23	7.50	6.70	7.18	7.08	1.23
C8	5.08	5.34	4.85	5.15	5.13	0.83
C9	3.65	3.83	3.60	3.75	3.74	0.57
C10	2.60	2.59	2.63	2.64	2.68	0.32
C11	2.05	2.01	2.10	2.00	2.00	0.25
C12	1.36	1.22	1.53	1.38	1.43	0.16
C13	0.93	0.79	2.75	1.09	1.12	0.11
C14	0.70	0.42	3.73	1.43	1.21	0.10
C15	0.33	0.19	0.71	0.73	1.03	0.11
alpha chain growth probability	0.63	0.60	0.68	0.68	0.70	0.55

C1 - C50 estimated total product distribution, weight %

C1	26.5	26.6	26.4	26.3	25.4	60.4
C2 - C4	29.5	29.2	26.6	26.7	26.1	28.6
C5 - C12	41.8	42.9	42.1	42.1	41.7	10.2
C13 - C50	2.2	1.3	4.9	4.8	6.8	0.7

CO conversion, %	8.5	8.1	7.5	7.2	7.5	25.0
rate, g CH ₂ /g cat/hr	0.45	0.43	0.40	0.38	0.40	1.34
CO ₂ formation, %	0.2	0.2	0.1	0.1	0.2	4.7

Performance of Co.053
 Dates: 03/23/95 - 03/24/95 Run #12

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.2 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	33.5	36.5	39.5	42.5	45.5
reaction temperature, °C	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

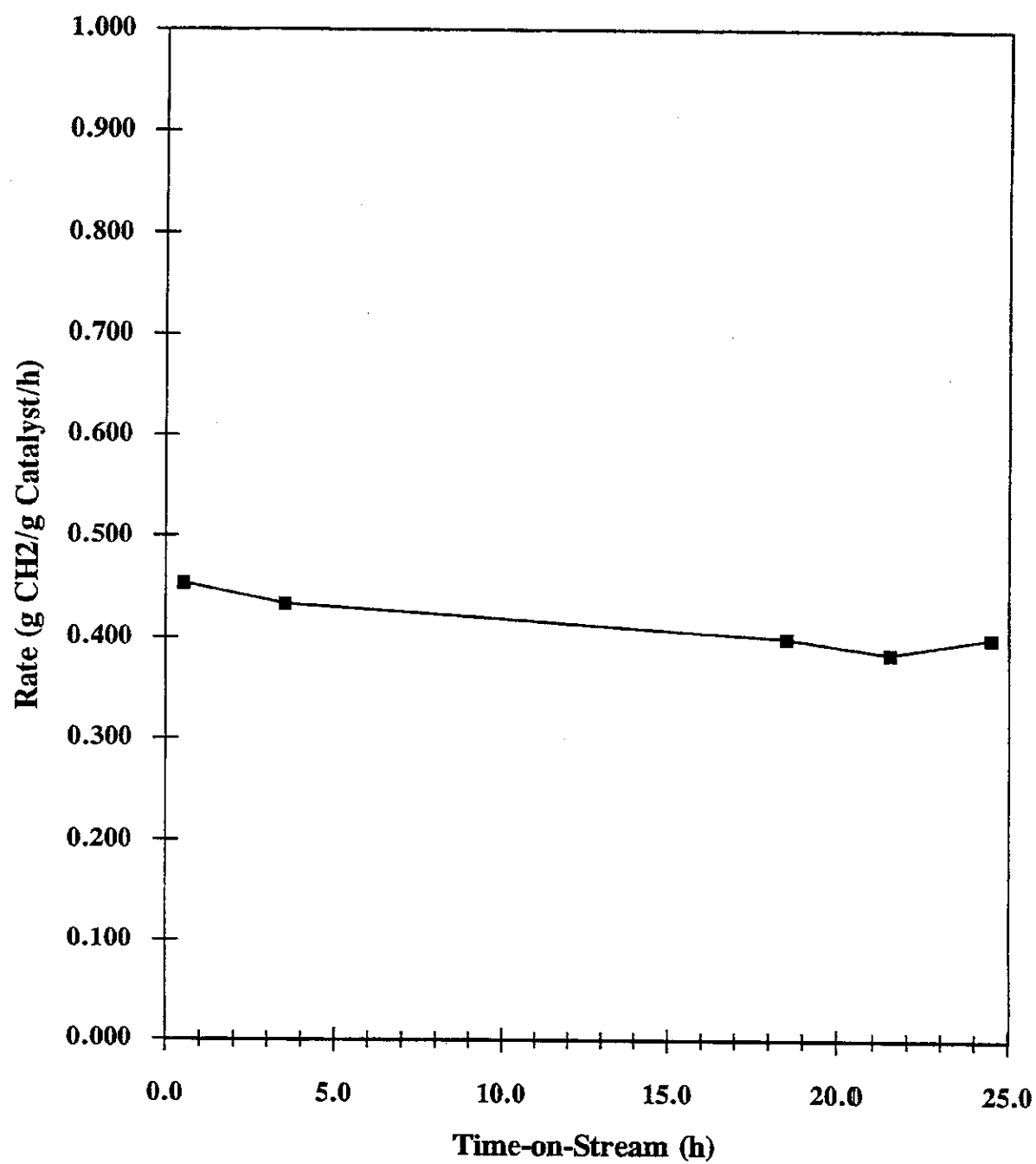
C1	49.90	46.39	44.25	42.94	41.67
C2	9.11	10.00	10.75	11.46	11.89
C3	15.30	14.80	14.53	14.45	14.25
C4	9.01	9.02	9.05	9.07	8.95
C5	6.13	6.49	6.75	6.84	6.83
C6	2.93	3.94	4.30	4.52	4.66
C7	2.47	2.84	3.14	3.22	3.33
C8	1.67	1.89	2.09	2.33	2.30
C9	1.08	1.30	1.43	1.49	1.58
C10	0.72	0.90	1.03	1.06	1.19
C11	0.50	0.68	0.80	0.76	0.84
C12	0.37	0.44	0.49	0.54	0.61
C13	0.30	0.34	0.41	0.43	0.52
C14	0.25	0.40	0.47	0.48	0.65
C15	0.26	0.58	0.50	0.42	0.74
alpha chain growth probability	0.63	0.68	0.67	0.66	0.69

C1 - C50 estimated total product distribution, weight %

C1	48.9	44.2	42.6	41.7	39.4
C2 - C4	32.7	32.2	33.0	33.9	33.1
C5 - C12	16.7	19.8	21.1	21.6	22.7
C13 - C50	1.7	3.8	3.3	2.7	4.8

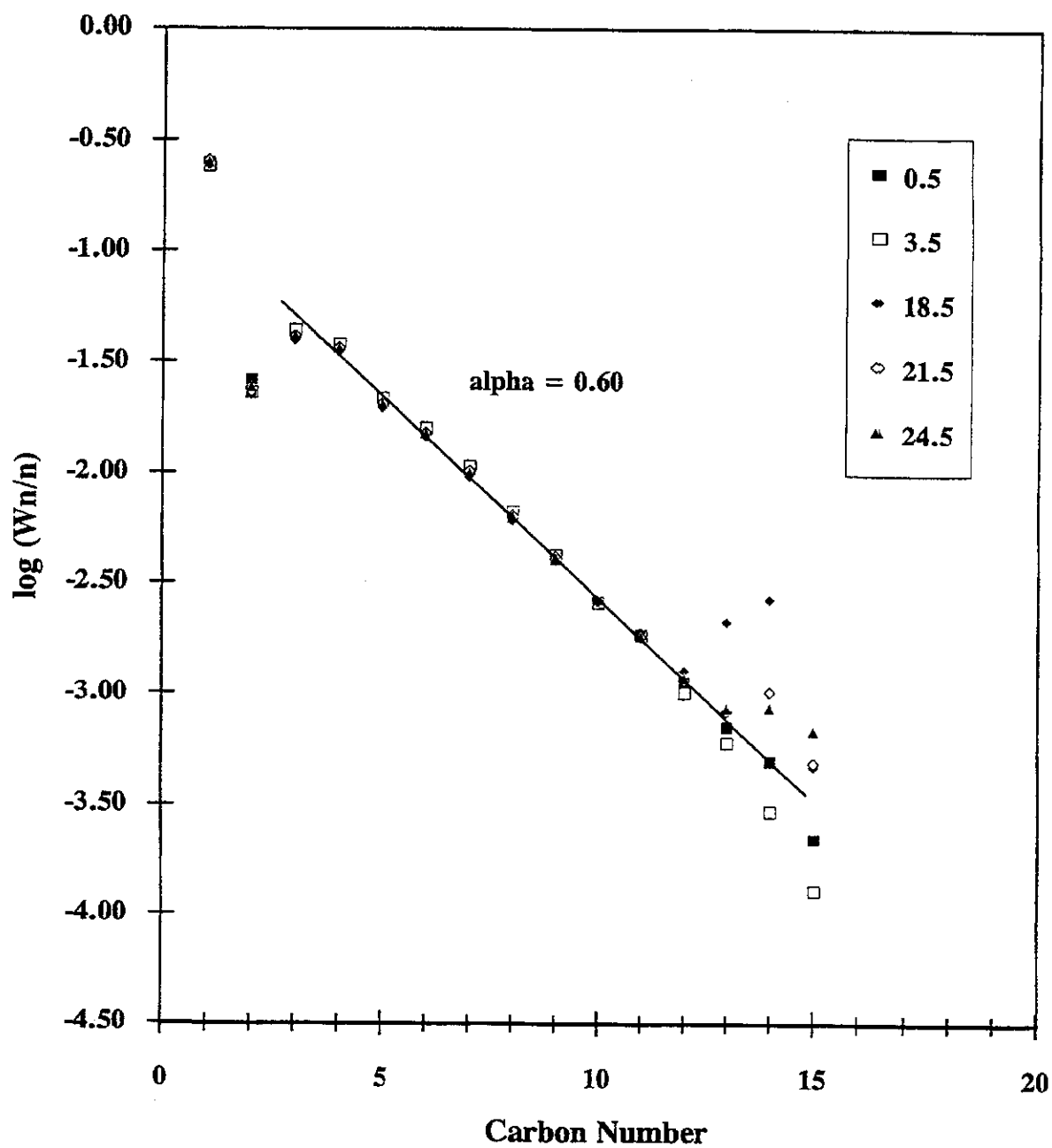
CO conversion, %	11.8	8.9	7.0	5.9	5.3
rate, g CH ₂ /g cat/hr	0.63	0.48	0.38	0.32	0.28
CO ₂ formation, %	1.2	0.9	0.6	0.5	0.4

Time-on-Stream Plot for C0.053 - Run #12



Schulz-Flory Plot for Co.053 - Run #12
Time on Stream (hrs)

hrs.



Co.053 - Run #12a

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.50			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 280 °C

H₂/CO = 2

weight of catalyst = 0.210 g

WHSV = 12.24 1/hr

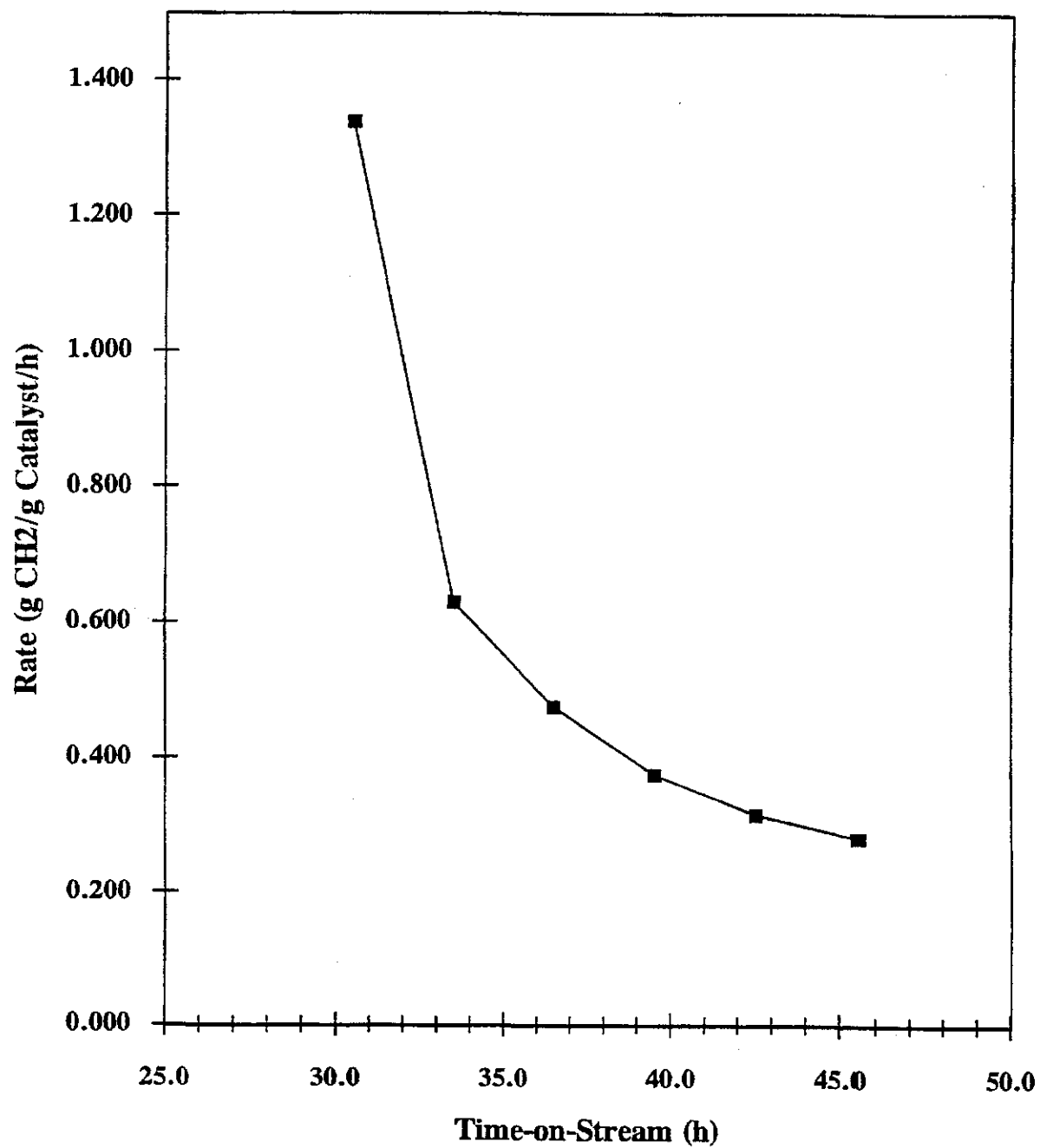
time on stream = 45.5 hrs

CO₂ (g/g cat/hr) = 0.083CO₂ (% of CO) = 0.4

O/P = 9.41

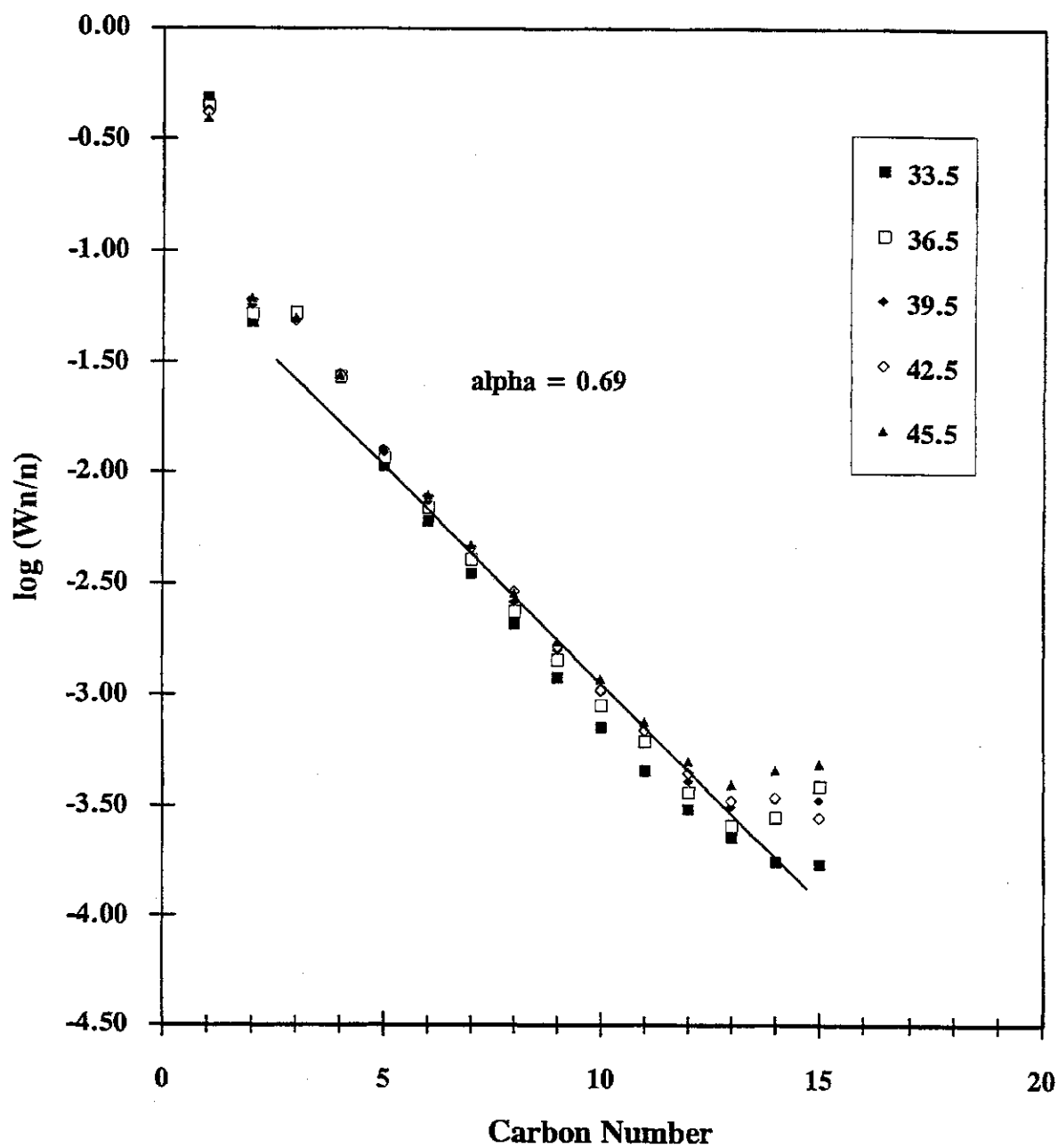
CO conversion (%)	5.3
rate (g CH ₂ /g cat/hr)	0.28
alpha	0.69
C1 (wt%)	39.4
C2 - C4 (wt%)	33.1
C5 - C12 (wt%)	22.7
C13 + (wt%)	4.8

Time-on-Stream Plot for C0.053 - Run #12a



Schulz-Flory Plot for Co.053 - Run #12a
Time on Stream (hrs)

hrs.



Co.053 - Run #12b

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.50			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.210 g
 WHSV = 12.24 1/hr
 time on stream = 3.5 hrs

CO₂ (g/g cat/hr) = 0.021
 CO₂ (% of CO) = 0.1
 O/P = 5.07

CO conversion (%)	1.4
rate (g CH ₂ /g cat/hr)	0.08
alpha	0.78
C1 (wt%)	20.0
C2 - C4 (wt%)	21.8
C5 - C12 (wt%)	38.8
C13 + (wt%)	19.5

Performance of Co.053

Dates: 03/29/95 - 03/30/95 Run #12b

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.2 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	0.5	3.5	0.5	6.5	9.5	12.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	23.55	24.31	32.10	31.31	31.24	30.83
C2	6.72	6.77	5.47	5.26	5.24	5.17
C3	9.97	9.94	13.05	12.13	12.17	12.12
C4	9.69	9.74	13.48	12.14	12.15	12.09
C5	9.81	9.52	10.70	11.16	11.22	11.30
C6	7.26	7.91	7.82	8.12	8.23	8.47
C7	6.74	6.44	6.09	6.47	6.48	6.54
C8	5.34	5.16	4.09	4.37	4.33	4.38
C9	4.36	4.18	2.78	3.00	2.97	2.96
C10	3.55	3.43	1.83	1.89	1.88	1.95
C11	2.84	2.82	1.37	1.46	1.44	1.47
C12	2.54	2.28	0.72	0.95	0.91	0.93
C13	2.39	2.10	0.35	0.72	0.58	0.59
C14	2.72	2.52	0.12	0.72	0.55	0.56
C15	2.51	2.87	0.04	0.30	0.62	0.64
alpha chain growth probability	0.77	0.78	0.52	0.62	0.66	0.66

C1 - C50 estimated total product distribution, weight %

C1	20.2	20.0	32.6	31.2	30.0	29.6
C2 - C4	22.6	21.8	32.5	29.4	28.4	28.2
C5 - C12	40.0	38.8	34.6	37.4	37.6	38.1
C13 - C50	17.3	19.5	0.3	2.0	4.0	4.1

CO conversion, %	1.4	1.4	9.0	8.8	8.8	8.5
rate, g CH ₂ /g cat/hr	0.07	0.08	0.48	0.47	0.47	0.45
CO ₂ formation, %	0.1	0.1	0.2	0.2	0.2	0.2

Performance of Co.053

Dates: 03/29/95 - 03/30/95 Run #12b

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.2 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	15.5	18.5	21.5
reaction temperature, °C	220	220	220
pressure, atm	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	30.84	30.69	30.26
C2	5.15	5.11	5.40
C3	12.12	12.13	12.19
C4	12.10	12.10	12.25
C5	11.23	11.30	11.23
C6	8.40	8.50	8.47
C7	6.52	6.57	6.49
C8	4.39	4.42	4.41
C9	3.02	3.02	3.05
C10	1.97	1.99	2.08
C11	1.48	1.52	1.55
C12	0.92	0.87	0.88
C13	0.68	0.63	0.60
C14	0.58	0.54	0.58
C15	0.62	0.60	0.55
alpha chain growth probability	0.66	0.66	0.65

C1 - C50 estimated total product distribution, weight %

C1	29.7	29.6	29.3
C2 - C4	28.2	28.3	28.9
C5 - C12	38.1	38.3	38.2
C13 - C50	4.0	3.9	3.6

CO conversion, %	8.4	8.4	8.3
rate, g CH ₂ /g cat/hr	0.45	0.45	0.44
CO ₂ formation, %	0.2	0.2	0.2

Co.053 - Run #13

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.50			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

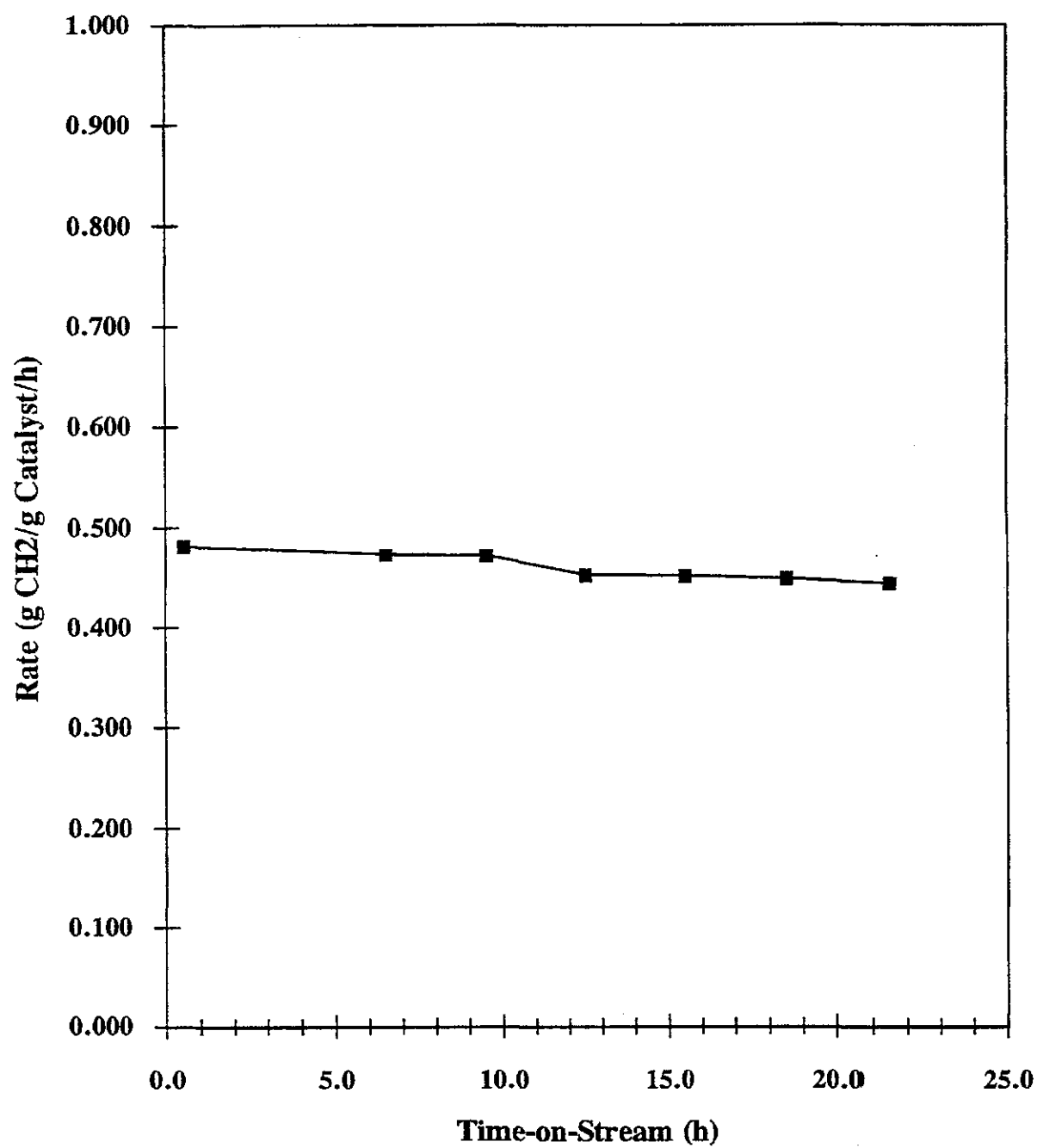
P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.210 g
 WHSV = 12.24 1/hr
 time on stream = 21.5 hrs

CO₂ (g/g cat/hr) = 0.037
 CO₂ (% of CO) = 0.2
 O/P = 0.88

CO conversion (%)	8.3
rate (g CH ₂ /g cat/hr)	0.44
alpha	0.65
C1 (wt%)	29.3
C2 - C4 (wt%)	28.9
C5 - C12 (wt%)	38.2
C13 + (wt%)	3.6

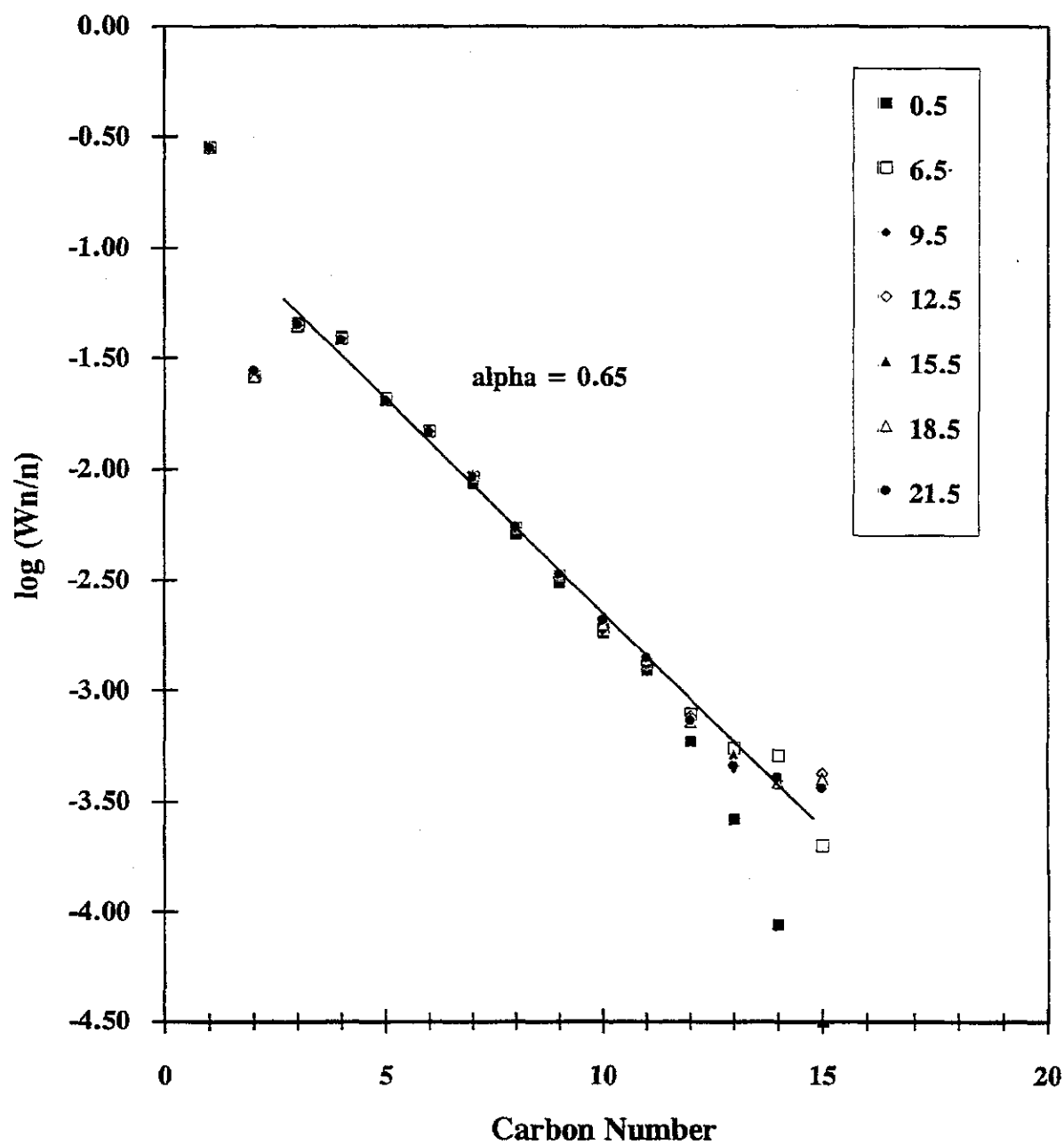
* calcined and reduced insitu after run 12

Time-on-Stream Plot for C0.053 - Run #13



Schulz-Flory Plot for Co.053 - Run #13
Time on Stream (hrs)

hrs.



Co.053 - Run #14

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.50			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.201 g
 WHSV = 12.78 1/hr
 time on stream = 19.5 hrs

CO₂ (g/g cat/hr) = 0.025
 CO₂ (% of CO) = 0.1
 O/P = 0.85

CO conversion (%)	6.7
rate (g CH ₂ /g cat/hr)	0.37
alpha	0.74
C1 (wt%)	24.8
C2 - C4 (wt%)	24.4
C5 - C12 (wt%)	37.3
C13 + (wt%)	13.6

* Catalyst calcined (24 hr, 300 °C) and reduced (10 hr, 350 °C) after reaction at E1

Performance of Co.053

Dates: 04/17/95 - 04/18/95 Run #14

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.8 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	1.5	4.5	7.5	10.5	13.5	16.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	29.35	28.82	29.92	29.95	29.06	29.68
C2	4.95	5.17	5.29	5.11	4.88	4.96
C3	12.23	12.16	12.51	12.45	12.07	12.24
C4	12.13	12.12	12.53	12.29	11.90	12.01
C5	11.23	11.15	11.49	11.47	11.16	11.19
C6	8.04	8.15	8.52	8.30	8.10	8.01
C7	6.42	6.33	6.54	6.46	6.38	6.38
C8	4.26	4.23	4.38	4.34	4.26	4.25
C9	2.90	2.89	2.97	2.79	2.94	2.90
C10	1.85	1.88	2.09	2.30	2.10	1.89
C11	1.43	1.44	1.62	1.57	1.60	1.38
C12	1.10	1.19	0.87	0.90	1.05	0.98
C13	1.75	2.10	0.54	0.62	0.94	0.87
C14	1.26	1.24	0.39	0.60	2.42	2.21
C15	1.11	1.13	0.33	0.84	1.16	1.03
alpha chain growth probability	0.70	0.70	0.62	0.68	0.70	0.69

C1 - C50 estimated total product distribution, weight %

C1	27.4	27.0	29.6	28.2	27.1	27.9
C2 - C4	27.4	27.5	30.0	28.1	26.9	27.5
C5 - C12	38.0	38.1	38.3	38.3	38.4	38.0
C13 - C50	7.2	7.3	2.2	5.4	7.5	6.7

CO conversion, %	6.8	6.4	5.7	5.9	6.1	6.0
rate, g CH ₂ /g cat/hr	0.38	0.36	0.32	0.33	0.34	0.33
CO ₂ formation, %	0.1	0.1	0.1	0.1	0.2	0.1

4/25/95

Performance of Co.053

Dates: 04/17/95 - 04/18/95 Run #14

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.8 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	19.5
reaction temperature, °C	220
pressure, atm	1.0
flow, cc/min	90.0

C1 - C15 product distribution, weight %

C1	29.27
C2	4.88
C3	12.06
C4	11.82
C5	11.09
C6	8.20
C7	6.26
C8	4.19
C9	2.84
C10	2.02
C11	1.55
C12	0.91
C13	0.82
C14	1.93
C15	2.15
alpha chain growth probability	0.74

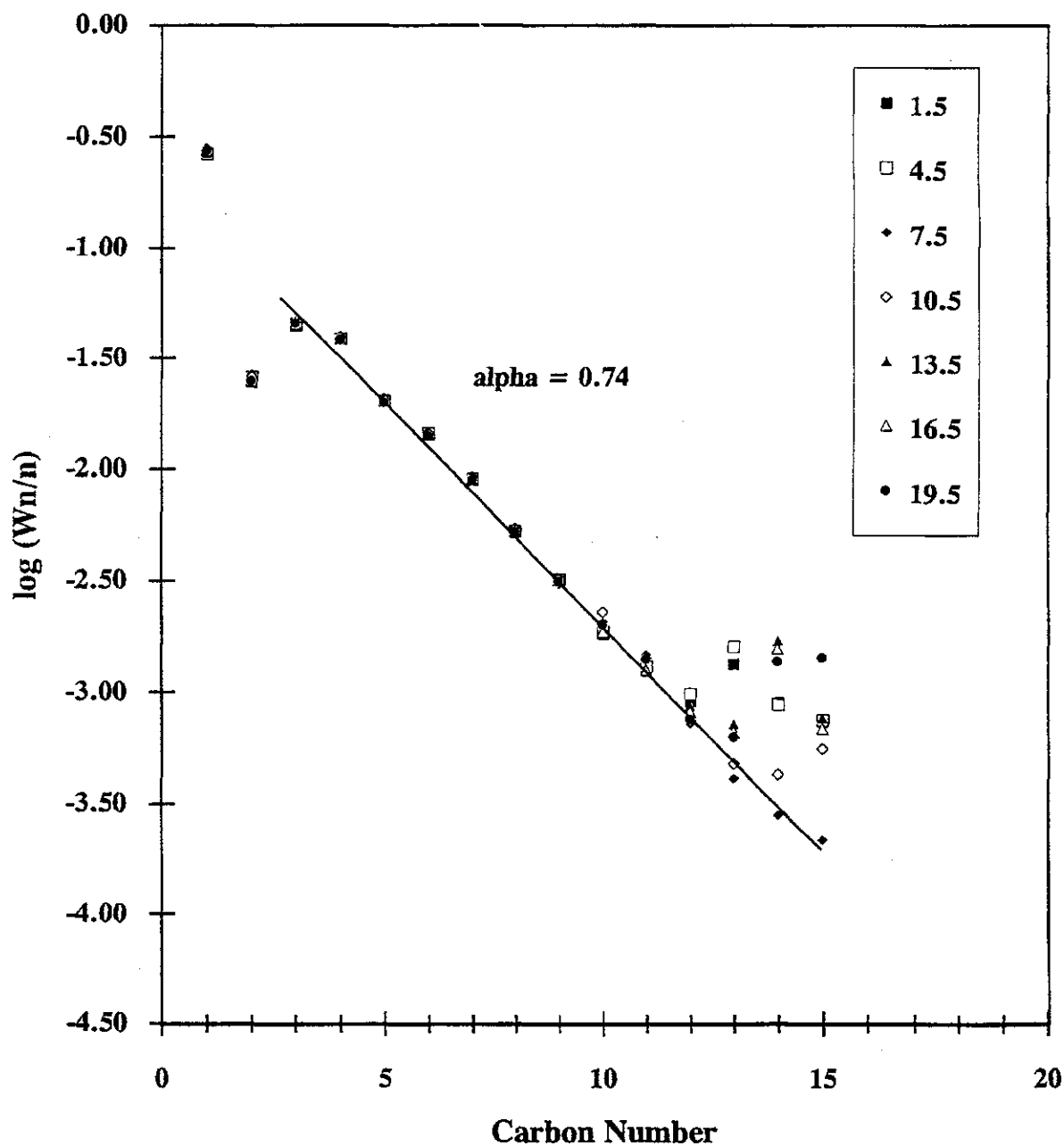
C1 - C50 estimated total product distribution, weight %

C1	24.8
C2 - C4	24.4
C5 - C12	37.3
C13 - C50	13.6

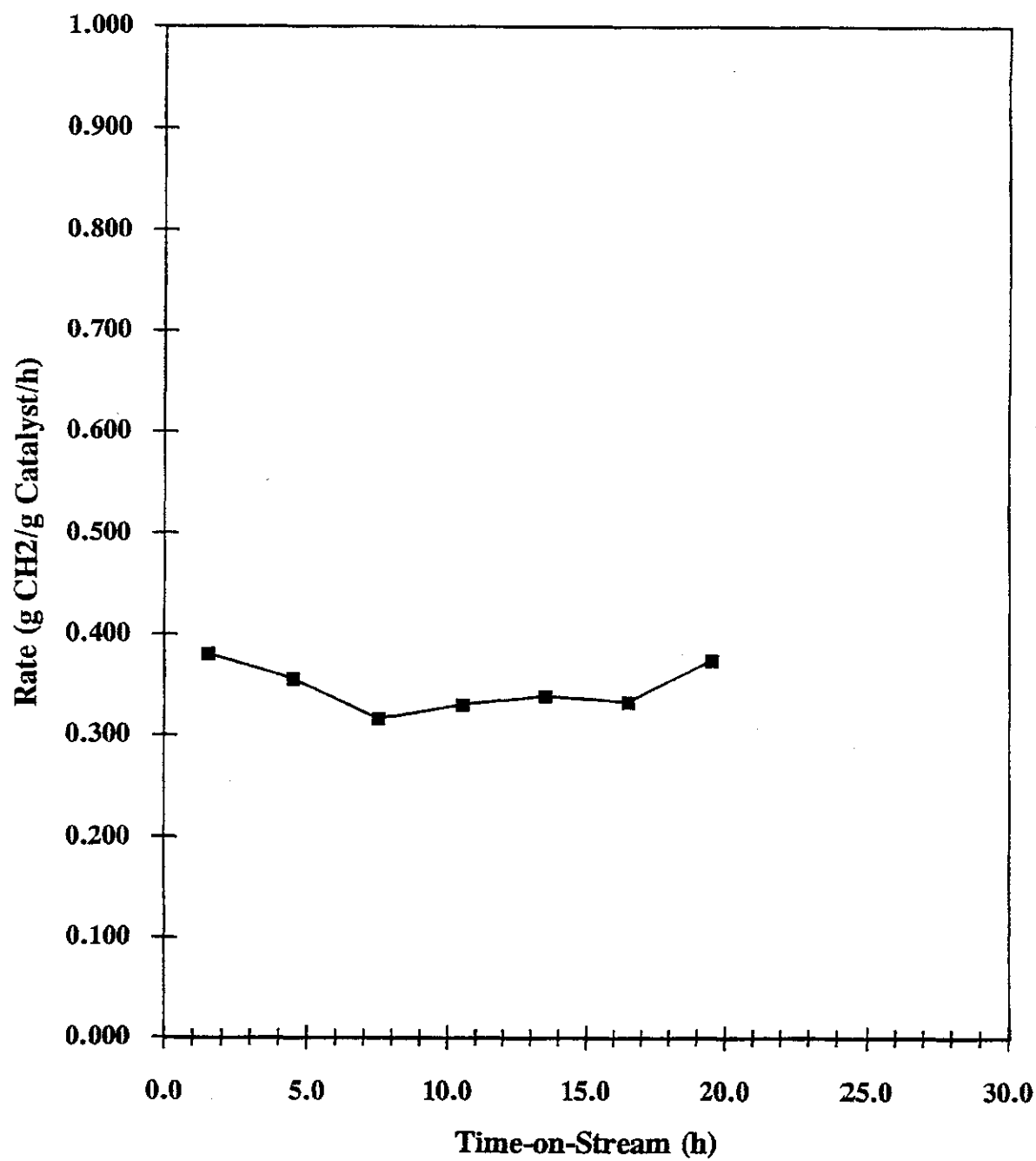
CO conversion, %	6.7
rate, g CH ₂ /g cat/hr	0.37
CO ₂ formation, %	0.1

Schulz-Flory Plot for Co.053 - Run #14
Time on Stream (hrs)

hrs.



Time-on-Stream Plot for Co.053 - Run #14



Co055 - Run #X

Co wt%	NM wt %	Promotor wt%		Support
20	Re 1.00	La 1.00		Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.200 g

WHSV = 12.86 1/hr

time on stream = 26.5 hrs

CO₂ (% of CO) =

O/P = 0.04

0.00

CO conversion (%)	6.1
rate (g CH ₂ /g cat/hr)	0.34
alpha	0.66
C1 (wt%)	29.7
C2 - C4 (wt%)	29.4
C5 - C12 (wt%)	37.6
C13 + (wt%)	3.3

Performance of Co055

Dates: 05/29/95 - 05/31/95 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	2.5	5.5	8.5	11.5	17.5	20.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	27.06	28.11	27.75	27.81	29.81	29.59
C2	4.76	4.86	4.75	4.92	5.22	5.13
C3	12.36	12.33	11.85	11.71	12.35	12.05
C4	12.50	12.29	11.65	11.75	12.24	11.78
C5	12.14	11.89	11.29	10.84	11.42	10.99
C6	9.55	9.40	9.45	8.56	8.94	8.70
C7	6.64	6.41	6.11	5.80	6.12	5.80
C8	4.81	4.69	4.38	4.19	4.43	4.24
C9	3.42	3.33	3.13	2.84	3.16	3.03
C10	2.56	2.48	2.18	2.37	2.35	2.30
C11	1.72	1.80	1.87	1.61	1.69	1.64
C12	1.38	1.25	1.37	1.27	1.19	1.22
C13	0.65	0.68	1.02	0.79	0.64	0.36
C14	0.33	0.36	0.76	0.59	0.32	1.17
C15	0.14	0.13	0.54	0.47	0.12	0.47
alpha chain growth probability	0.61	0.61	0.67	0.65	0.61	0.70

C1 - C50 estimated total product distribution, weight %

C1	27.3	28.3	27.8	28.9	30.0	28.3
C2 - C4	29.9	29.7	28.3	29.4	30.0	27.7
C5 - C12	41.4	40.5	40.2	38.9	38.5	38.2
C13 - C50	1.5	1.6	3.7	2.8	1.4	5.8

CO conversion, %	7.1	6.7	6.9	6.6	6.2	6.7
rate, g CH ₂ /g cat/hr	0.40	0.38	0.39	0.37	0.35	0.38
CO ₂ formation, %						

Performance of Co055

Dates: 05/29/95 - 05/31/95 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	23.5	26.5	32.5	35.5	38.5	41.5
reaction temperature, °C	220	220	220	220	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	29.75	29.55	32.32	31.84	51.85	37.13
C2	5.18	5.26	5.46	5.32	9.62	12.67
C3	12.07	12.15	12.80	12.45	16.93	16.00
C4	11.79	11.78	11.46	11.05	9.12	9.97
C5	10.90	10.75	10.64	9.97	5.42	7.45
C6	8.58	8.43	10.16	7.65	2.98	4.94
C7	5.72	5.71	5.06	4.75	1.37	3.07
C8	4.19	4.17	3.52	3.32	0.98	2.18
C9	2.86	3.03	2.35	2.24	0.61	1.61
C10	2.44	2.13	1.60	1.75	0.41	1.06
C11	1.75	1.82	1.20	1.39	0.29	0.69
C12	1.16	1.37	0.79	0.75	0.20	0.51
C13	0.88	0.85	0.46	0.45	0.15	0.42
C14	0.64	0.69	0.43	0.34	0.08	0.31
C15	0.49	0.50	0.34	0.49	0.00	0.23
alpha chain growth probability	0.66	0.66	0.63	0.62	0.55	0.62

C1 - C50 estimated total product distribution, weight %

C1	29.9	29.7	32.4	34.0	51.7	37.4
C2 - C4	29.2	29.4	29.8	30.8	35.6	39.0
C5 - C12	37.9	37.6	35.8	33.7	12.3	22.2
C13 - C50	3.0	3.3	1.9	1.6	0.3	1.4

CO conversion, %	6.3	6.1	5.3	5.3	15.4	6.3
rate, g CH ₂ /g cat/hr	0.35	0.34	0.30	0.30	0.86	0.36
CO ₂ formation, %						

Performance of Co055
 Dates: 05/29/95 - 05/31/95 Run #X

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	47.5	50.5	53.5	56.5	59.5	62.5
reaction temperature, °C	280	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

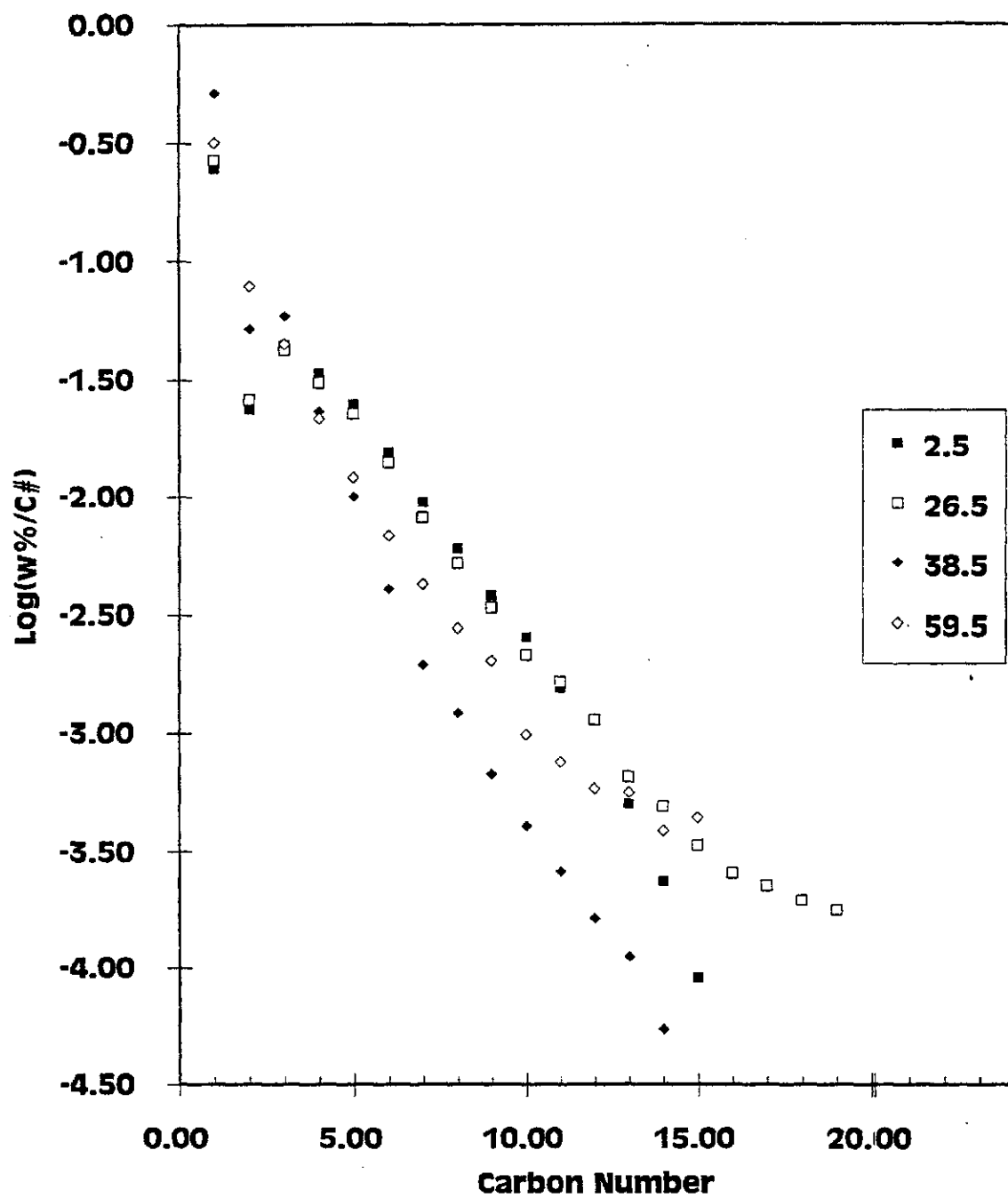
C1	33.68	33.08	33.66	34.02	35.43	38.66
C2	14.77	15.66	16.26	16.22	16.14	16.36
C3	15.51	15.26	15.08	14.07	13.14	13.04
C4	9.57	9.37	9.15	8.36	7.73	7.38
C5	7.15	7.11	6.58	6.16	5.90	5.46
C6	4.70	2.93	2.88	2.59	1.93	1.76
C7	3.27	3.37	3.22	3.24	2.97	2.61
C8	2.46	2.49	2.43	2.40	2.24	1.96
C9	1.75	1.93	1.70	1.77	1.82	1.30
C10	1.30	1.36	1.34	1.28	0.99	1.03
C11	0.98	1.18	0.92	0.85	0.83	0.74
C12	0.66	0.73	0.84	0.69	0.71	0.66
C13	0.49	0.59	0.61	0.69	0.74	0.43
C14	0.44	0.55	0.45	0.47	0.54	0.45
C15	0.37	0.48	0.46	0.55	0.66	0.55
alpha chain growth probability	0.64	0.66	0.68	0.68	0.67	0.66

C1 - C50 estimated total product distribution, weight %

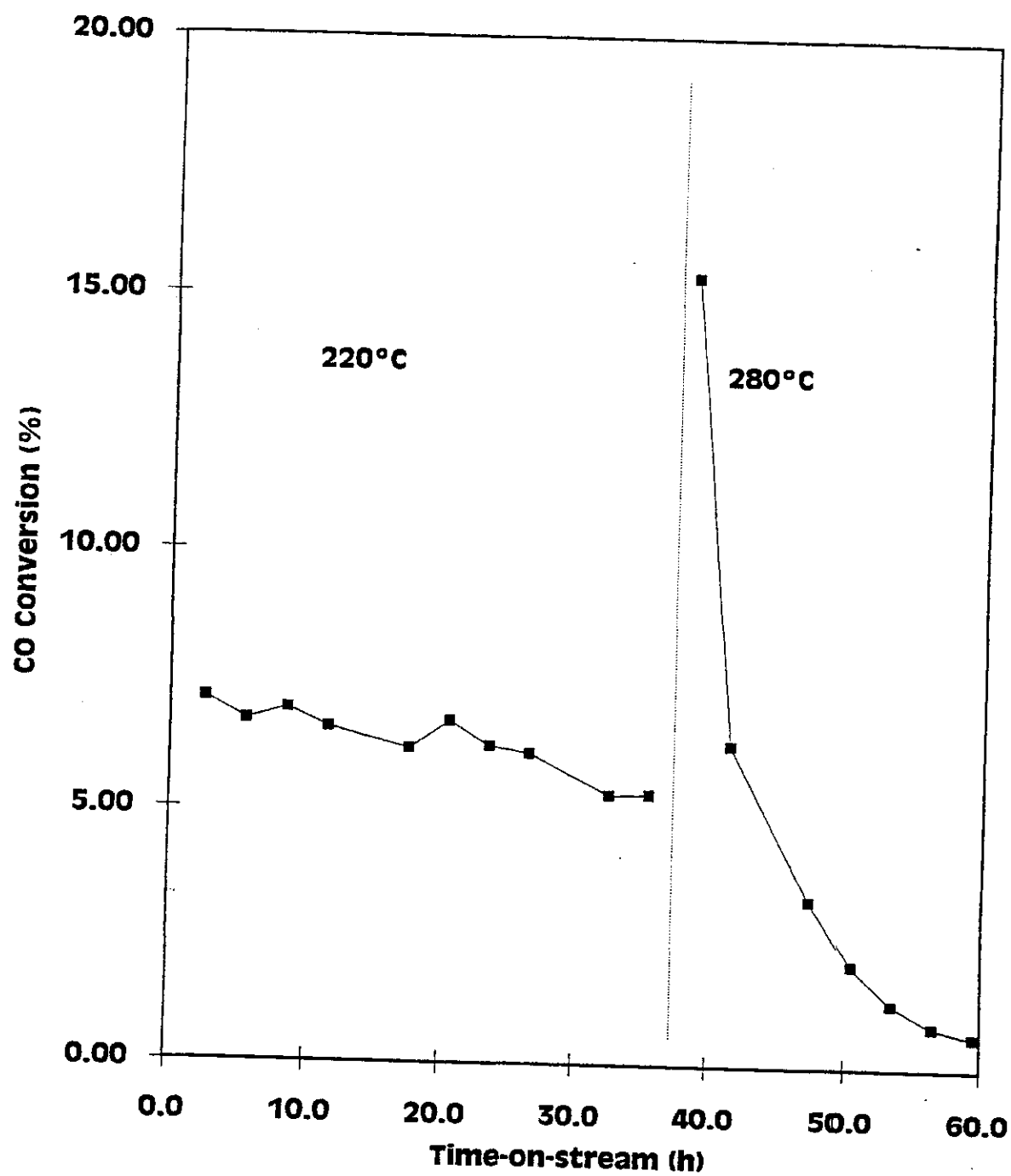
C1	34.2	33.8	34.9	36.0	37.9	41.2
C2 - C4	40.5	41.2	42.0	40.9	39.6	39.2
C5 - C12	23.2	22.3	20.9	20.6	19.6	17.3
C13 - C50	2.1	2.7	2.3	2.4	2.8	2.3

CO conversion, %	3.3	2.1	1.3	0.9	0.7	0.7
rate, g CH ₂ /g cat/hr	0.19	0.12	0.07	0.05	0.04	0.04
CO ₂ formation, %						

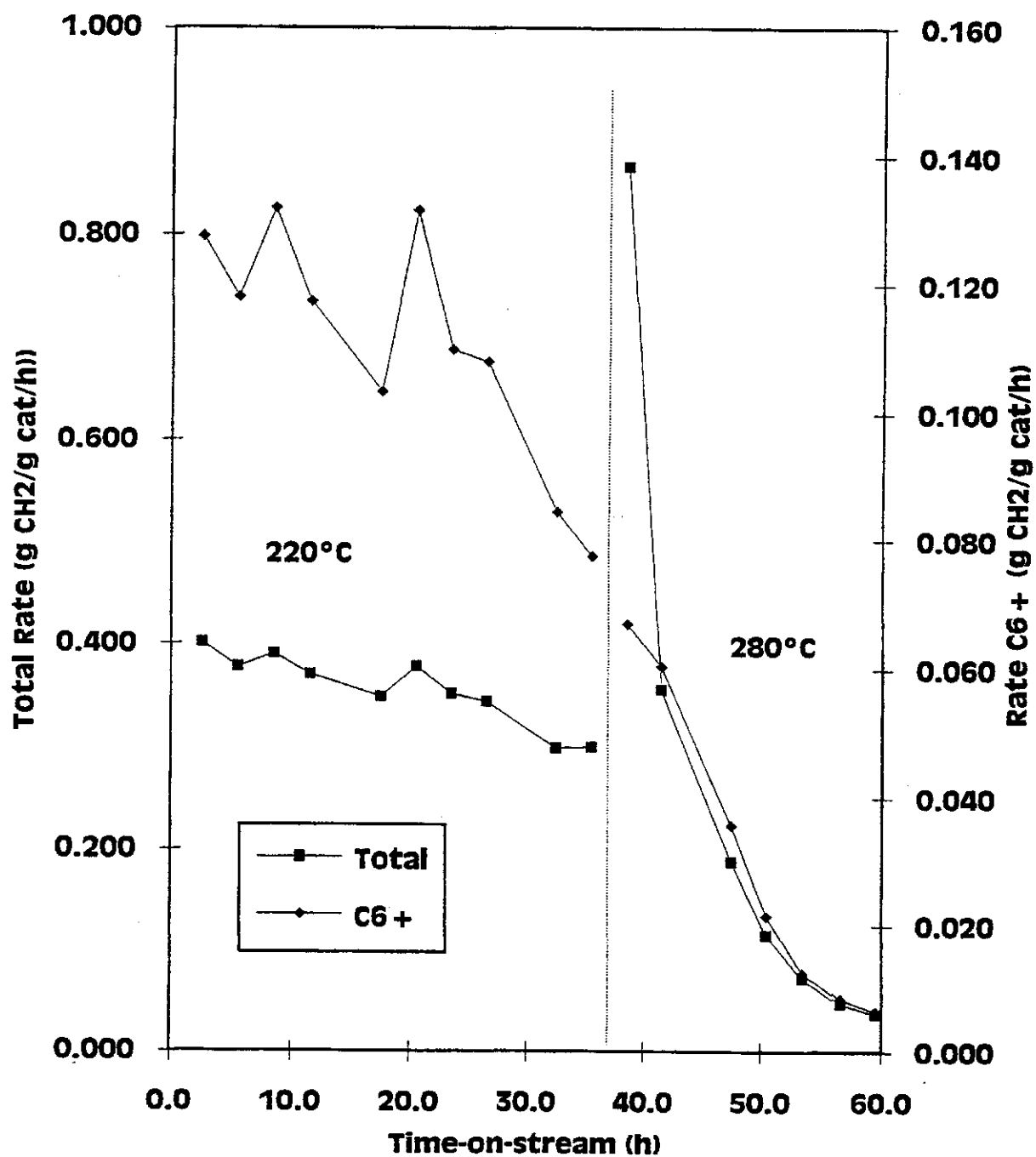
CO Hydrogenation on Co.055 - ASF Product Distribution



CO Hydrogenation on Co.055



CO Hydrogenation on Co.055



Co.064 - Run #1

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.50		Zr 8.50	Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.208 g

WHSV = 12.36 1/hr

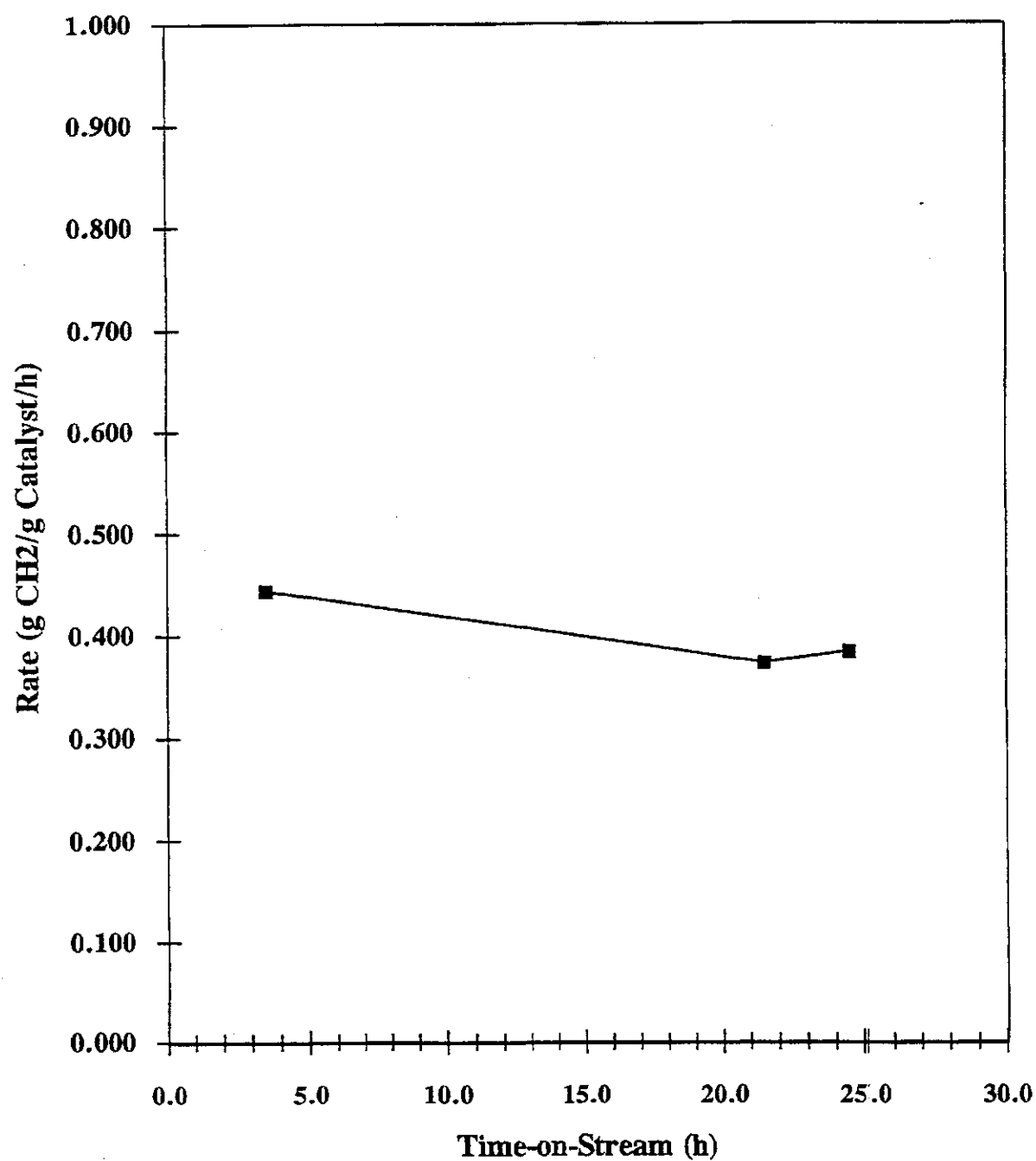
time on stream = 24.5 hrs

CO₂ (g/g cat/hr) = 0.028CO₂ (% of CO) = 0.2

O/P = 1.58

CO conversion (%)	7.1
rate (g CH ₂ /g cat/hr)	0.38
alpha	0.64
C1 (wt%)	27.5
C2 - C4 (wt%)	28.4
C5 - C12 (wt%)	41.5
C13 + (wt%)	2.7

Time-on-Stream Plot for Co.064 - Run #1



Performance of Co.064

Dates: 04/11/95 - 04/12/95 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.4 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	3.5	21.5	24.5
reaction temperature, °C	220	220	220
pressure, atm	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	28.79	28.40	27.58
C2	5.44	3.25	4.61
C3	13.05	12.20	11.78
C4	11.30	11.80	12.14
C5	12.01	11.57	11.67
C6	9.28	9.08	8.43
C7	6.71	7.11	7.15
C8	4.67	5.03	5.13
C9	3.22	3.63	3.70
C10	2.08	2.44	2.53
C11	1.52	1.93	1.90
C12	0.90	1.19	1.25
C13	0.58	1.00	0.89
C14	0.32	0.96	0.86
C15	0.13	0.42	0.40
alpha chain growth probability	0.57	0.64	0.64

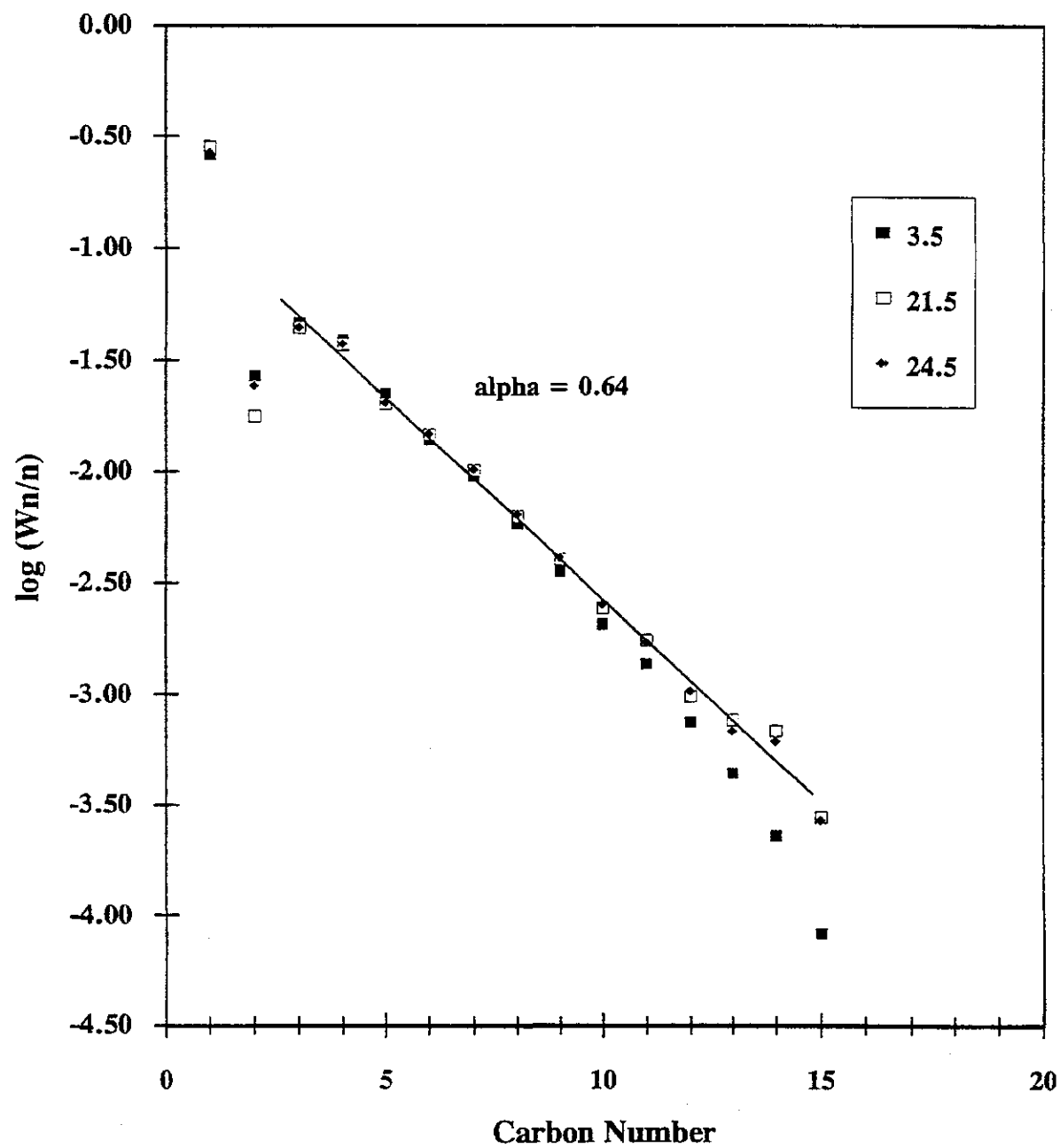
C1 - C50 estimated total product distribution, weight %

C1	29.1	28.3	27.5
C2 - C4	30.1	27.1	28.4
C5 - C12	39.8	41.8	41.5
C13 - C50	0.9	2.8	2.7

CO conversion, %	8.2	6.9	7.1
rate, g CH ₂ /g cat/hr	0.44	0.37	0.38
CO ₂ formation, %	0.2	0.2	0.2

Schulz-Flory Plot for Co.064 - Run #1
Time on Stream (hrs)

hrs.



Co.066 - Run #1

Co wt%	NM wt %	Promotor wt%		Support
15	Ru 0.50	Fe 5.00		Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.200 g

WHSV = 12.86 1/hr

time on stream = 23.5 hrs

CO₂ (% of CO) =

O/P = 0

0.00

CO conversion (%)	1.7
rate (g CH ₂ /g cat/hr)	0.10
alpha	0.67
C1 (wt%)	27.7
C2 - C4 (wt%)	29.4
C5 - C12 (wt%)	39.1
C13 + (wt%)	3.8

Performance of Co.066

Dates: 06/06/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	2.5	5.5	8.5	11.5	14.5	17.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	21.43	26.37	26.49	26.58	26.72	27.08
C2	22.13	5.89	5.86	5.85	5.85	5.95
C3	10.43	12.30	12.08	11.78	11.76	11.79
C4	10.20	11.89	11.72	11.57	11.45	11.48
C5	9.40	11.30	11.01	11.03	10.84	10.90
C6	7.08	8.38	7.95	8.09	8.13	7.64
C7	4.81	5.71	5.65	5.71	5.59	5.78
C8	3.43	3.96	3.99	4.05	4.00	3.99
C9	2.42	2.86	2.85	2.95	2.85	2.90
C10	1.89	2.14	2.18	2.26	2.21	2.25
C11	1.34	1.58	1.59	1.59	1.58	1.52
C12	1.00	1.24	1.27	1.24	1.21	1.17
C13	0.75	0.92	0.94	0.94	0.90	0.89
C14	0.59	0.72	0.78	0.75	0.69	0.76
C15	0.60	0.69	0.74	0.76	0.70	0.67
alpha chain growth probability	0.65	0.66	0.67	0.67	0.66	0.67

C1 - C50 estimated total product distribution, weight %

C1	21.7	27.0	27.3	27.4	27.9	27.9
C2 - C4	43.2	30.8	30.6	30.1	30.3	30.1
C5 - C12	32.3	38.7	38.3	38.7	38.4	38.1
C13 - C50	2.8	3.5	3.9	3.7	3.4	3.8

CO conversion, %	2.6	2.0	1.9	1.8	1.8	1.7
rate, g CH ₂ /g cat/hr	0.14	0.11	0.11	0.10	0.10	0.10
CO ₂ formation, %						

Performance of Co.066

Dates: 06/06/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	20.5	23.5	26.5	29.5	32.5	35.5
reaction temperature, °C	220	220	220	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	29.62	26.87	28.52	52.47	40.76	37.34
C2	6.45	5.88	6.42	9.21	12.13	13.62
C3	12.35	11.38	12.43	16.57	14.97	14.67
C4	11.61	11.24	11.58	8.88	9.30	9.36
C5	10.25	10.88	10.84	5.33	6.84	7.15
C6	5.88	8.60	8.16	2.80	4.43	2.54
C7	5.41	5.71	5.39	1.43	2.86	3.35
C8	3.86	4.11	3.66	0.91	1.96	2.36
C9	2.72	2.92	2.58	0.56	1.37	1.67
C10	2.09	2.29	1.96	0.36	1.05	1.43
C11	1.53	1.62	1.29	0.27	0.73	0.88
C12	1.11	1.17	1.01	0.17	0.50	0.71
C13	0.87	0.92	0.71	0.11	0.36	0.54
C14	0.70	0.76	0.55	0.09	0.32	0.49
C15	0.64	0.74	0.56	0.06	0.23	0.38
alpha chain growth probability	0.66	0.67	0.65	0.55	0.62	0.65

C1 - C50 estimated total product distribution, weight %

C1	30.6	27.7	29.5	52.7	41.2	38.0
C2 - C4	31.4	29.4	31.4	34.8	36.8	38.4
C5 - C12	34.6	39.1	36.5	12.1	20.5	21.3
C13 - C50	3.4	3.8	2.6	0.4	1.4	2.3

CO conversion, %	1.0	1.7	1.6	8.9	3.7	2.3
rate, g CH ₂ /g cat/hr	0.06	0.10	0.09	0.50	0.21	0.13
CO ₂ formation, %						

Performance of Co.066
 Dates: 06/06/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	38.5	41.5	44.5	48.8	51.8	54.8
reaction temperature, °C	280	280	280	280	280	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

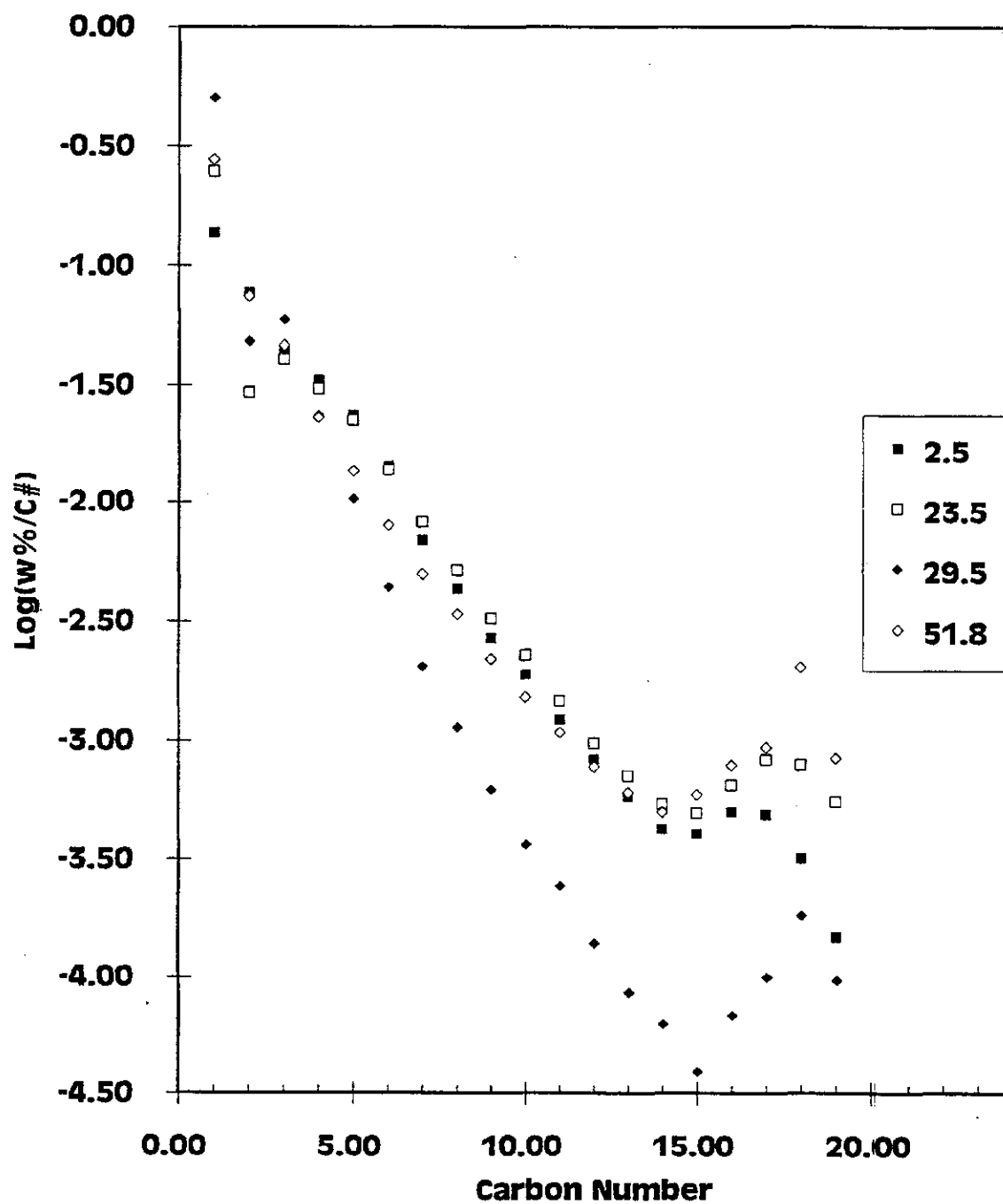
C1	36.00	34.36	32.81	31.89	30.85	19.75
C2	14.57	14.91	14.97	15.13	15.22	12.07
C3	14.57	14.30	13.95	13.81	13.46	7.69
C4	9.28	9.06	8.75	8.74	8.56	6.72
C5	6.93	6.88	6.76	6.86	6.66	6.81
C6	2.81	2.96	2.92	3.00	2.94	1.91
C7	3.40	3.43	3.46	3.52	3.47	4.37
C8	2.46	2.53	2.57	2.67	2.70	3.64
C9	1.78	1.90	1.92	1.99	1.98	3.13
C10	1.36	1.41	1.37	1.44	1.53	2.77
C11	0.95	1.02	1.05	1.15	1.19	2.48
C12	0.76	0.80	0.81	0.89	0.93	2.05
C13	0.60	0.67	0.79	0.79	0.78	1.81
C14	0.62	0.57	0.62	0.67	0.70	1.71
C15	0.49	0.56	0.65	0.73	0.89	1.99
alpha chain growth probability	0.67	0.67	0.67	0.68	0.68	0.77

C1 - C50 estimated total product distribution, weight %

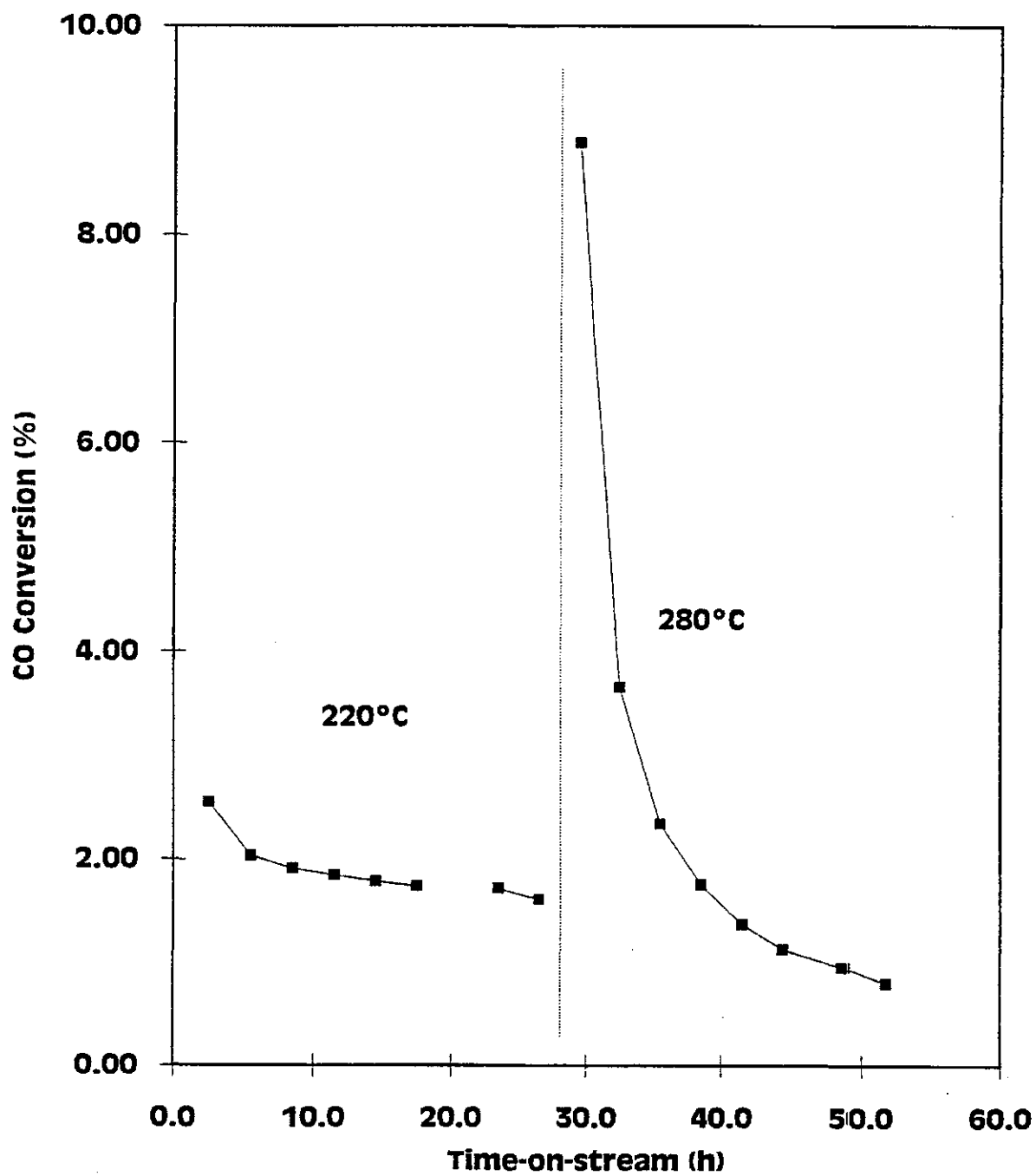
C1	36.4	35.4	34.4	33.5	32.9	23.1
C2 - C4	38.8	39.4	39.5	39.6	39.7	30.9
C5 - C12	21.8	22.4	22.9	23.5	23.8	32.7
C13 - C50	3.1	2.8	3.2	3.5	3.7	13.3

CO conversion, %	1.8	1.4	1.1	1.0	0.8	0.2
rate, g CH ₂ /g cat/hr	0.10	0.08	0.06	0.05	0.05	0.01
CO ₂ formation, %						

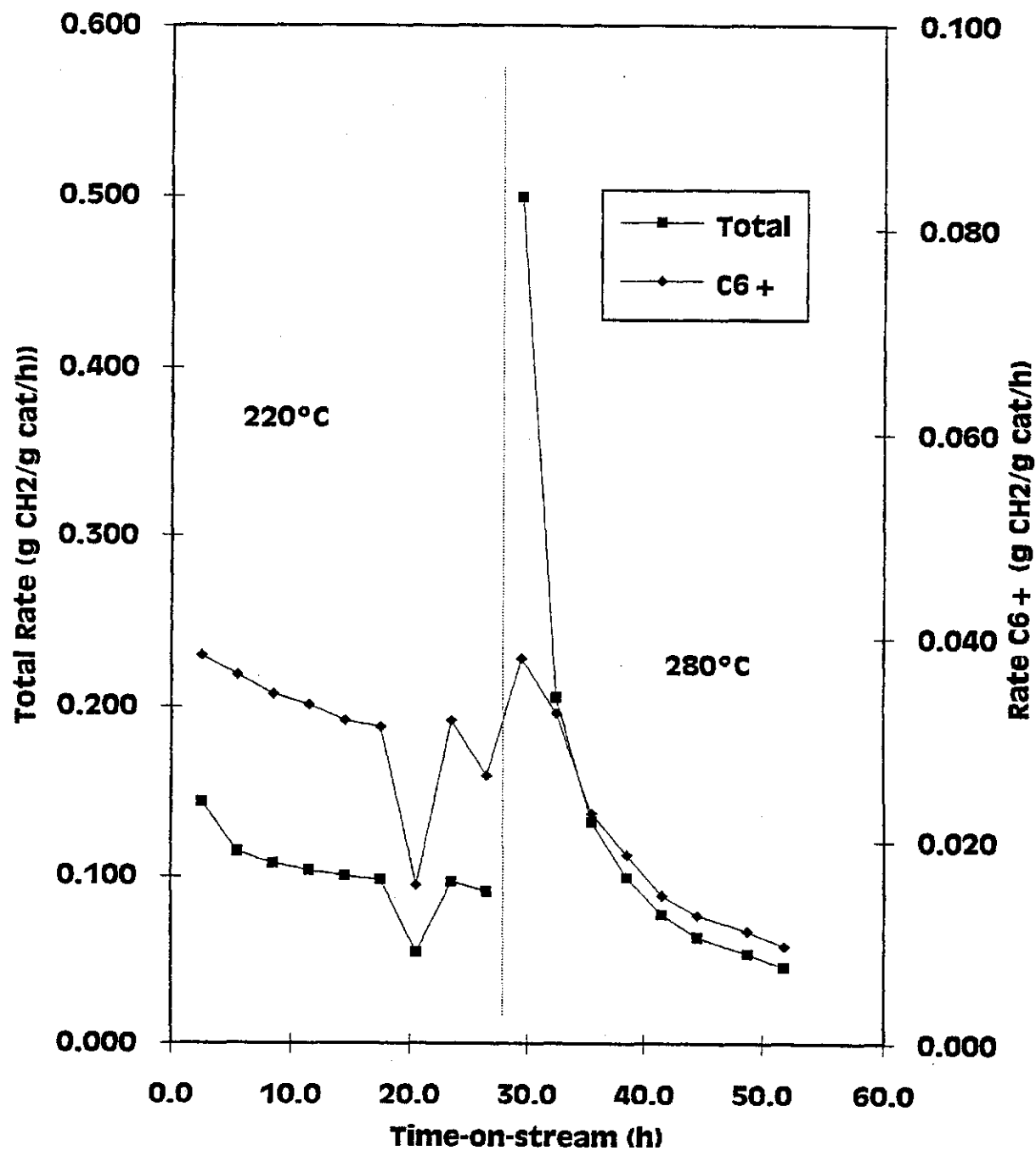
CO Hydrogenation on Co.066 - ASF Product Distribution



CO Hydrogenation on Co.066



CO Hydrogenation on Co.066



Co.067 - Run #1

Co wt%	NM wt %	Promotor wt%		Support
20	Pd 2.00			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.200 g

WHSV = 12.87 1/hr

time on stream = 20.5 hrs

CO₂ (% of CO) =

O/P = 0

0.00

CO conversion (%)	2.2
rate (g CH ₂ /g cat/hr)	0.13
alpha	0.67
C1 (wt%)	25.0
C2 - C4 (wt%)	29.2
C5 - C12 (wt%)	41.6
C13 + (wt%)	4.2

Performance of Co.067

Dates: 06/21/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	2.5	5.5	8.5	11.5	14.5	17.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	22.57	23.06	23.20	23.59	23.90	24.18
C2	6.05	6.09	6.07	6.13	6.16	6.22
C3	11.11	11.13	10.92	10.94	10.96	11.03
C4	11.91	11.66	11.45	11.39	11.27	11.36
C5	11.83	11.48	11.35	11.40	11.28	11.22
C6	9.35	9.03	9.12	8.94	8.51	8.87
C7	6.67	6.51	6.44	6.41	6.33	6.27
C8	4.89	4.69	4.63	4.66	4.65	4.58
C9	3.45	3.43	3.37	3.47	3.33	3.34
C10	2.57	2.51	2.58	2.50	2.52	2.47
C11	1.94	1.83	1.84	1.78	1.85	1.74
C12	1.49	1.43	1.37	1.33	1.38	1.32
C13	1.10	1.05	1.01	0.97	0.99	0.96
C14	0.95	0.90	0.88	0.86	0.85	0.82
C15	1.14	1.01	1.00	1.01	0.97	0.95
alpha chain growth probability	0.68	0.68	0.68	0.68	0.68	0.67

C1 - C50 estimated total product distribution, weight %

C1	22.7	23.5	23.8	24.2	24.7	24.9
C2 - C4	29.3	29.5	29.2	29.2	29.3	29.4
C5 - C12	43.2	42.4	42.5	42.2	41.7	41.6
C13 - C50	4.8	4.6	4.5	4.4	4.3	4.1

CO conversion, %	2.5	2.5	2.4	2.4	2.3	2.2
rate, g CH ₂ /g cat/hr	0.14	0.14	0.14	0.13	0.13	0.13
CO ₂ formation, %						

Performance of Co.067

Dates: 06/21/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	20.5	23.5	26.5	29.5	32.5	35.5
reaction temperature, °C	220	220	220	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	24.15	25.95	30.58	66.56	60.66	58.94
C2	6.19	6.88	8.07	12.18	11.49	11.25
C3	10.93	11.85	13.86	10.76	12.36	12.61
C4	11.19	11.45	13.36	5.41	6.86	7.19
C5	11.15	11.00	12.69	2.65	3.88	4.34
C6	8.72	8.39	9.53	0.95	1.86	2.22
C7	6.31	5.87	3.22	0.46	0.95	1.15
C8	4.60	4.03	2.14	0.30	0.55	0.69
C9	3.35	2.59	1.52	0.20	0.33	0.38
C10	2.50	1.98	1.06	0.10	0.17	0.23
C11	1.77	1.41	0.78	0.08	0.10	0.14
C12	1.29	1.03	0.52	0.04	0.07	0.11
C13	0.95	0.72	0.38	0.03	0.07	0.07
C14	0.82	0.53	0.30	0.02	0.04	0.07
C15	0.96	0.64	0.29	0.03	0.04	0.09
alpha chain growth probability	0.67	0.64	0.62	0.46	0.53	0.55

C1 - C50 estimated total product distribution, weight %

C1	25.0	27.3	30.9	66.6	60.9	59.1
C2 - C4	29.2	31.7	35.6	28.4	30.8	31.1
C5 - C12	41.6	38.4	32.2	4.9	8.2	9.5
C13 - C50	4.2	2.6	1.4	0.1	0.2	0.3

CO conversion, %	2.2	1.9	1.7	13.1	8.0	6.5
rate, g CH ₂ /g cat/hr	0.13	0.11	0.10	0.74	0.45	0.37
CO ₂ formation, %						

Performance of Co.067
 Dates: 06/21/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	38.5	41.5	44.5	47.5	50.5	53.5
reaction temperature, °C	280	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	57.59	56.55	55.40	55.54	56.87	55.06
C2	11.09	11.07	11.07	11.30	10.87	11.48
C3	12.76	12.85	12.87	12.90	11.73	12.37
C4	7.39	7.53	7.60	7.49	7.12	7.35
C5	4.65	4.84	4.99	4.91	4.88	5.03
C6	2.46	2.62	2.82	2.66	2.57	2.46
C7	1.33	1.46	1.62	1.59	1.71	1.86
C8	0.82	0.86	0.99	0.96	1.07	1.18
C9	0.45	0.50	0.57	0.57	0.63	0.68
C10	0.28	0.29	0.35	0.34	0.42	0.37
C11	0.16	0.19	0.25	0.25	0.29	0.25
C12	0.13	0.12	0.18	0.15	0.18	0.19
C13	0.10	0.12	0.11	0.14	0.14	0.16
C14	0.07	0.09	0.10	0.10	0.12	0.14
C15	0.07	0.08	0.09	0.10	0.12	0.14
alpha chain growth probability	0.55	0.56	0.57	0.57	0.57	0.58

C1 - C50 estimated total product distribution, weight %

C1	57.8	56.8	55.7	55.9	57.4	55.4
C2 - C4	31.3	31.6	31.7	31.9	30.0	31.4
C5 - C12	10.6	11.3	12.1	11.8	12.2	12.6
C13 - C50	0.3	0.4	0.4	0.4	0.5	0.6

CO conversion, %	5.5	4.8	4.2	4.0	2.4	2.4
rate, g CH ₂ /g cat/hr	0.31	0.27	0.24	0.23	0.14	0.13
CO ₂ formation, %						

Performance of Co.067
 Dates: 06/21/95 - 01/00/00 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.9 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	56.5	59.5	62.5	65.5	68.5	71.5
reaction temperature, °C	280	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

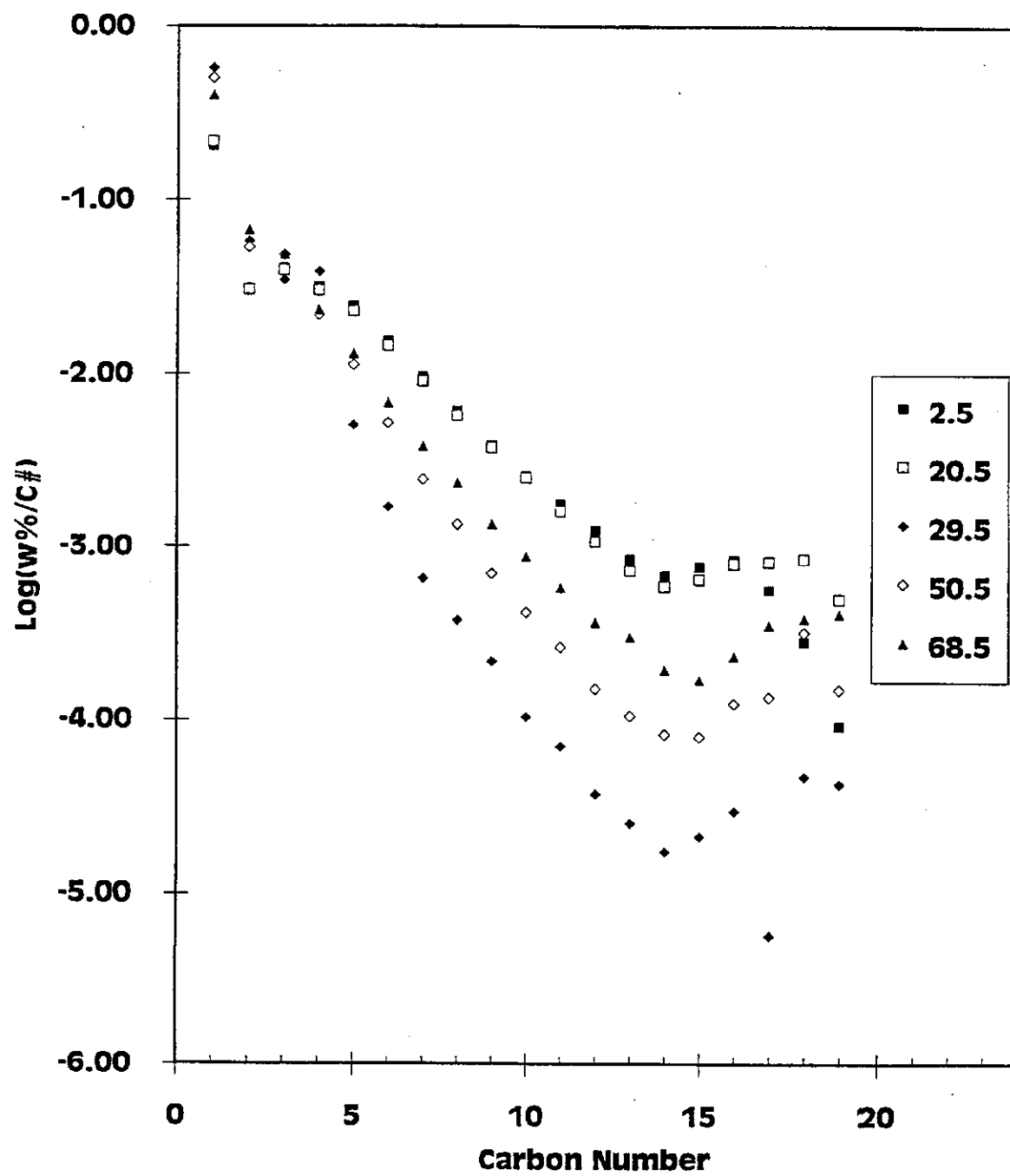
C1	52.76	49.08	48.91	45.85	43.56	47.86
C2	11.69	11.59	12.29	12.24	13.28	13.70
C3	12.53	12.21	12.67	12.35	13.83	12.80
C4	7.53	7.38	7.77	7.59	8.55	7.82
C5	5.18	5.18	5.60	5.48	6.22	5.77
C6	2.83	6.55	3.16	5.29	3.45	0.91
C7	2.03	2.03	2.28	2.71	2.68	2.55
C8	1.22	1.36	1.62	1.85	1.87	1.76
C9	0.79	0.88	1.01	1.17	1.21	1.15
C10	0.53	0.61	0.76	0.84	0.88	0.82
C11	0.40	0.46	0.53	0.60	0.65	0.64
C12	0.31	0.34	0.33	0.54	0.44	0.42
C13	0.22	0.22	0.27	0.38	0.39	0.35
C14	0.16	0.19	0.26	0.23	0.27	0.25
C15	0.14	0.16	0.20	0.24	0.26	0.26
alpha chain growth probability	0.59	0.60	0.62	0.61	0.62	0.62

C1 - C50 estimated total product distribution, weight %

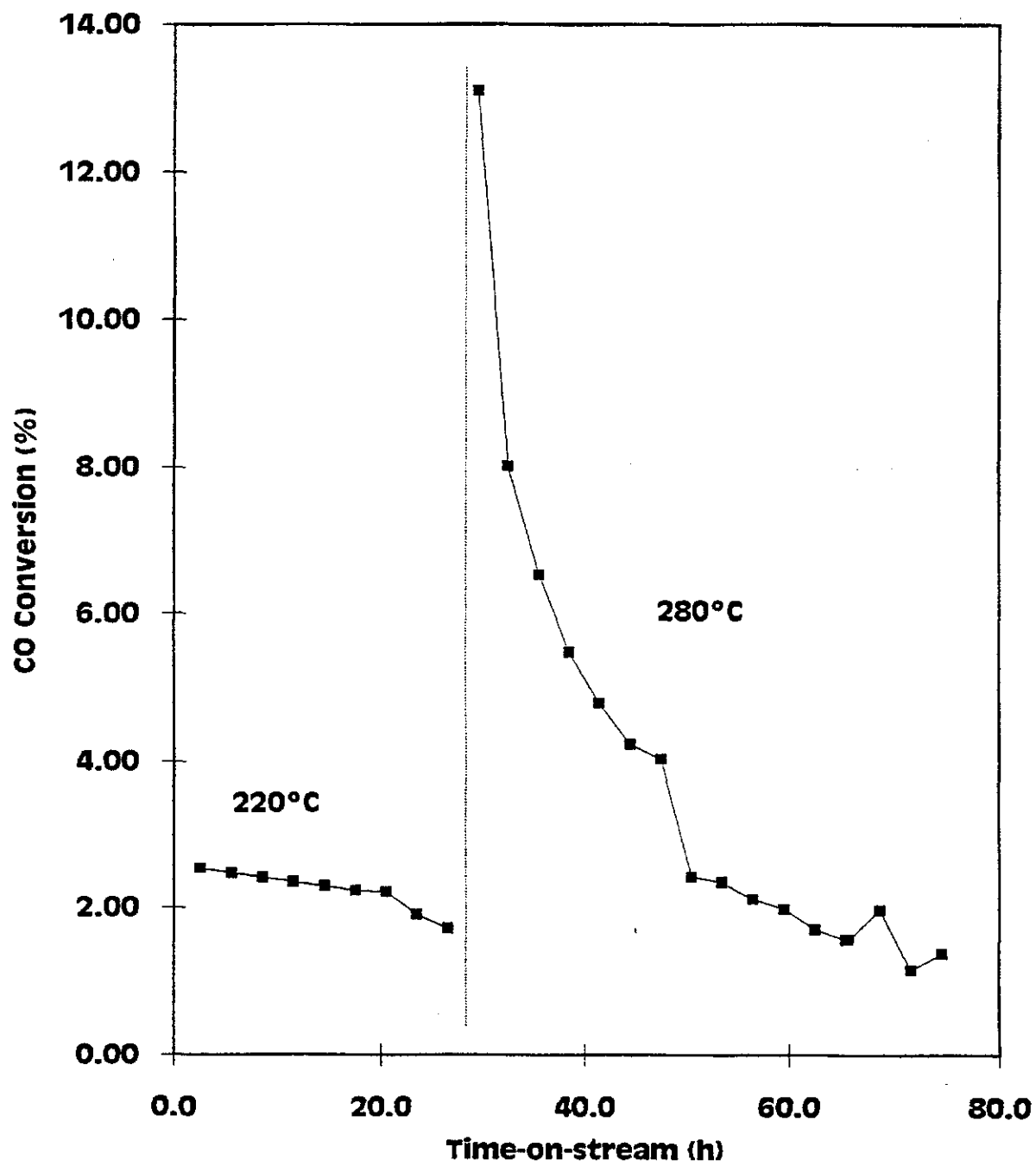
C1	53.4	49.6	49.6	46.9	44.3	49.0
C2 - C4	32.1	31.5	33.2	32.9	36.3	35.2
C5 - C12	13.8	18.0	16.1	19.1	18.2	14.7
C13 - C50	0.7	0.8	1.2	1.0	1.2	1.1

CO conversion, %	2.1	2.0	1.7	1.6	2.0	1.2
rate, g CH ₂ /g cat/hr	0.12	0.11	0.10	0.09	0.11	0.07
CO ₂ formation, %						

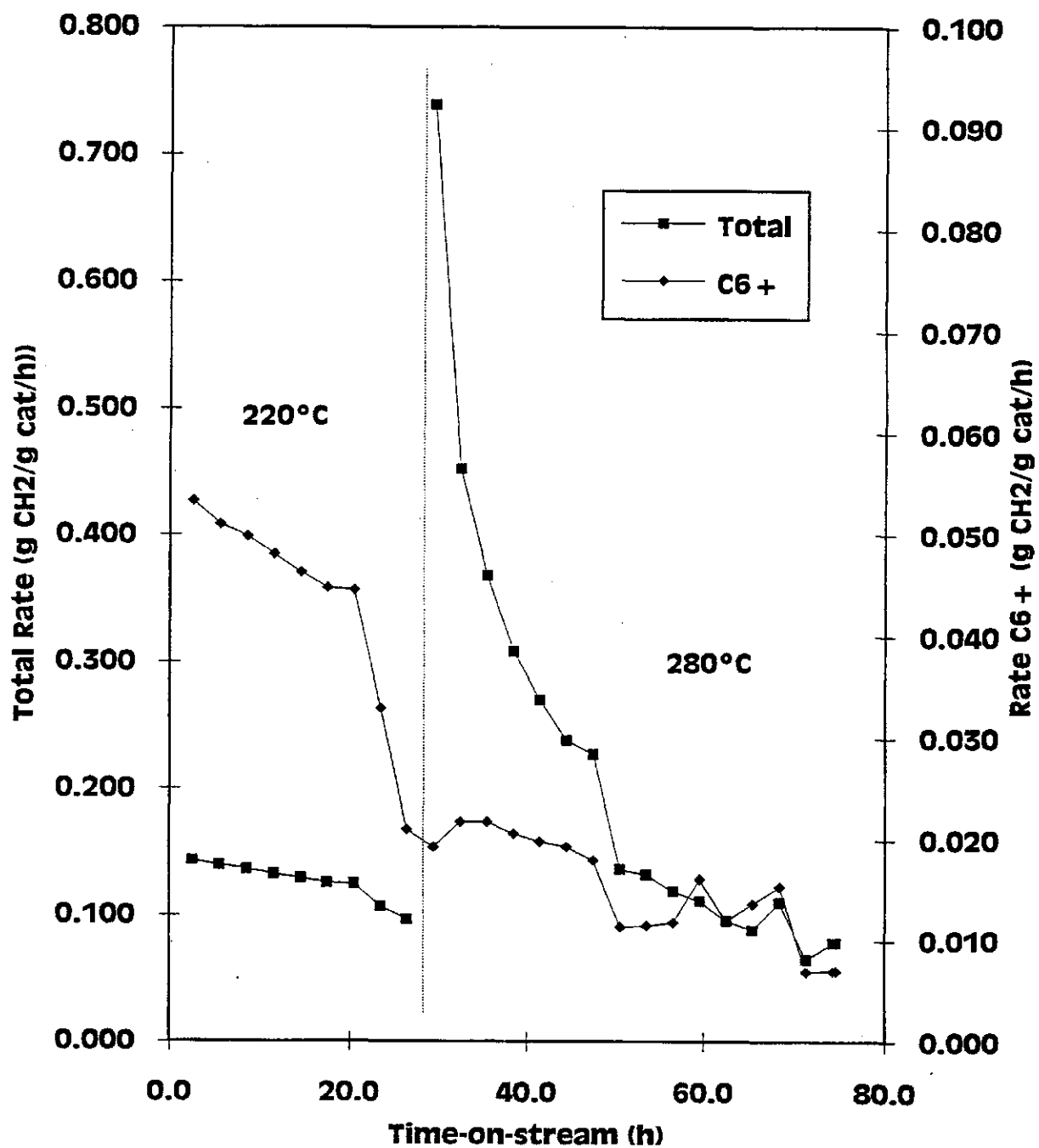
CO Hydrogenation on Co.067 - ASF Product Distribution



CO Hydrogenation on Co.067



CO Hydrogenation on Co.067



Co.068 - Run #1

Co wt%	NM wt %	Promotor wt%		Support
20	Pd 1.00			Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.201 g

WHSV = 12.80 1/hr

time on stream = 23.5 hrs

CO₂ (% of CO) =

O/P = 0.01

0.00

CO conversion (%)	4.0
rate (g CH ₂ /g cat/hr)	0.22
alpha	0.62
C1 (wt%)	28.8
C2 - C4 (wt%)	30.6
C5 - C12 (wt%)	38.7
C13 + (wt%)	1.9

Performance of Co.068

Dates: 06/26/95 - 06/29/95 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.8 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	2.5	5.5	8.5	11.5	14.5	17.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	26.52	27.34	27.20	27.45	28.47	27.95
C2	5.53	5.68	5.59	5.60	5.77	5.63
C3	11.57	12.09	11.92	11.96	12.32	12.07
C4	12.96	13.29	12.93	12.93	13.19	12.86
C5	12.76	12.84	12.58	12.54	12.91	12.46
C6	9.87	9.88	9.58	9.53	9.83	9.45
C7	6.47	6.46	6.30	6.32	6.43	5.70
C8	4.32	4.35	4.21	4.21	4.26	4.71
C9	2.88	2.86	2.80	2.77	0.03	2.66
C10	1.99	0.03	1.87	1.75	1.84	1.88
C11	1.29	1.31	1.23	1.29	1.25	1.20
C12	0.89	0.81	0.83	0.81	0.84	0.75
C13	0.57	0.56	0.54	0.54	0.50	0.53
C14	0.47	0.39	0.37	0.37	0.36	0.34
C15	0.42	0.34	0.35	0.32	0.31	0.29
alpha chain growth probability	0.64	0.63	0.63	0.63	0.63	0.62

C1 - C50 estimated total product distribution, weight %

C1	26.3	27.4	27.2	27.5	28.6	28.1
C2 - C4	29.9	31.1	30.4	30.6	31.4	30.7
C5 - C12	41.0	39.2	40.0	39.7	37.9	39.3
C13 - C50	2.8	2.3	2.4	2.1	2.1	1.9

CO conversion, %	4.2	4.1	4.3	4.3	4.1	4.2
rate, g CH ₂ /g cat/hr	0.24	0.23	0.24	0.24	0.23	0.24
CO ₂ formation, %						

Performance of Co.068

Dates: 06/26/95 - 06/29/95 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.8 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	20.5	23.5	26.5	29.5	32.5	35.5
reaction temperature, °C	220	220	220	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	28.31	28.64	33.49	76.42	63.85	59.62
C2	5.62	5.66	6.32	9.68	10.46	10.91
C3	11.98	12.10	12.70	7.74	12.05	12.81
C4	12.69	12.74	12.60	3.66	6.50	7.22
C5	12.44	12.30	11.49	1.52	3.63	4.40
C6	9.29	9.15	8.13	0.42	1.73	2.33
C7	5.68	6.14	5.20	0.15	0.76	1.09
C8	4.64	4.09	3.58	0.16	0.55	0.82
C9	2.75	2.70	2.10	0.12	0.24	0.40
C10	1.89	1.78	1.34	0.04	0.12	0.19
C11	1.25	1.29	0.73	0.04	0.08	0.13
C12	0.80	0.75	0.42	0.02	0.02	0.05
C13	0.49	0.48	0.30	0.02	0.02	0.03
C14	0.37	0.35	0.21	0.01	0.00	0.00
C15	0.28	0.28	0.17	0.00	0.00	0.00
alpha chain growth probability	0.62	0.62	0.59	0.44	0.42	0.46

C1 - C50 estimated total product distribution, weight %

C1	28.5	28.8	33.6	76.4	63.9	59.6
C2 - C4	30.4	30.6	31.7	21.1	29.0	30.9
C5 - C12	39.2	38.7	33.6	2.5	7.1	9.4
C13 - C50	1.9	1.9	1.1	0.0	0.0	0.1

CO conversion, %	3.8	4.0	2.4	15.8	7.6	5.6
rate, g CH ₂ /g cat/hr	0.22	0.22	0.13	0.88	0.42	0.31
CO ₂ formation, %						

Performance of Co.068
 Dates: 06/26/95 - 06/29/95 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.8 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	38.5	41.5	44.5	48.8	51.8	54.8
reaction temperature, °C	280	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %						
C1	56.38	50.32	48.69	46.69	45.90	44.80
C2	11.37	11.15	12.71	13.33	13.80	14.32
C3	13.22	12.64	14.66	14.76	14.72	14.75
C4	7.66	7.46	8.80	8.93	8.89	8.96
C5	4.96	7.73	6.13	6.30	6.38	6.45
C6	2.77	4.48	3.69	3.95	3.70	3.79
C7	1.39	2.36	1.96	2.34	2.49	2.59
C8	1.10	1.69	1.56	1.54	1.64	1.72
C9	0.54	0.87	0.79	0.91	1.01	1.10
C10	0.34	0.65	0.46	0.62	0.68	0.71
C11	0.17	0.34	0.27	0.34	0.38	0.41
C12	0.10	0.17	0.17	0.18	0.28	0.25
C13	0.00	0.13	0.10	0.12	0.12	0.14
C14	0.00	0.00	0.00	0.00	0.00	0.00
C15	0.00	0.00	0.00	0.00	0.00	0.00
alpha chain growth probability	0.49	0.53	0.53	0.53	0.56	0.55

C1 - C50 estimated total product distribution, weight %						
C1	56.3	50.3	48.6	46.6	45.7	44.7
C2 - C4	32.2	31.2	36.1	37.0	37.3	37.9
C5 - C12	11.4	18.2	15.0	16.1	16.6	17.0
C13 - C50	0.1	0.2	0.2	0.2	0.4	0.4

CO conversion, %	4.5	4.0	4.3	3.5	2.7	2.4
rate, g CH ₂ /g cat/hr	0.25	0.22	0.24	0.20	0.15	0.14
CO ₂ formation, %						

Performance of Co.068
 Dates: 06/26/95 - 06/29/95 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 12.8 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	57.8	61.8	64.8	67.8	70.6	0.0
reaction temperature, °C	280	280	280	280	220	0
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	0.0

C1 - C15 product distribution, weight %

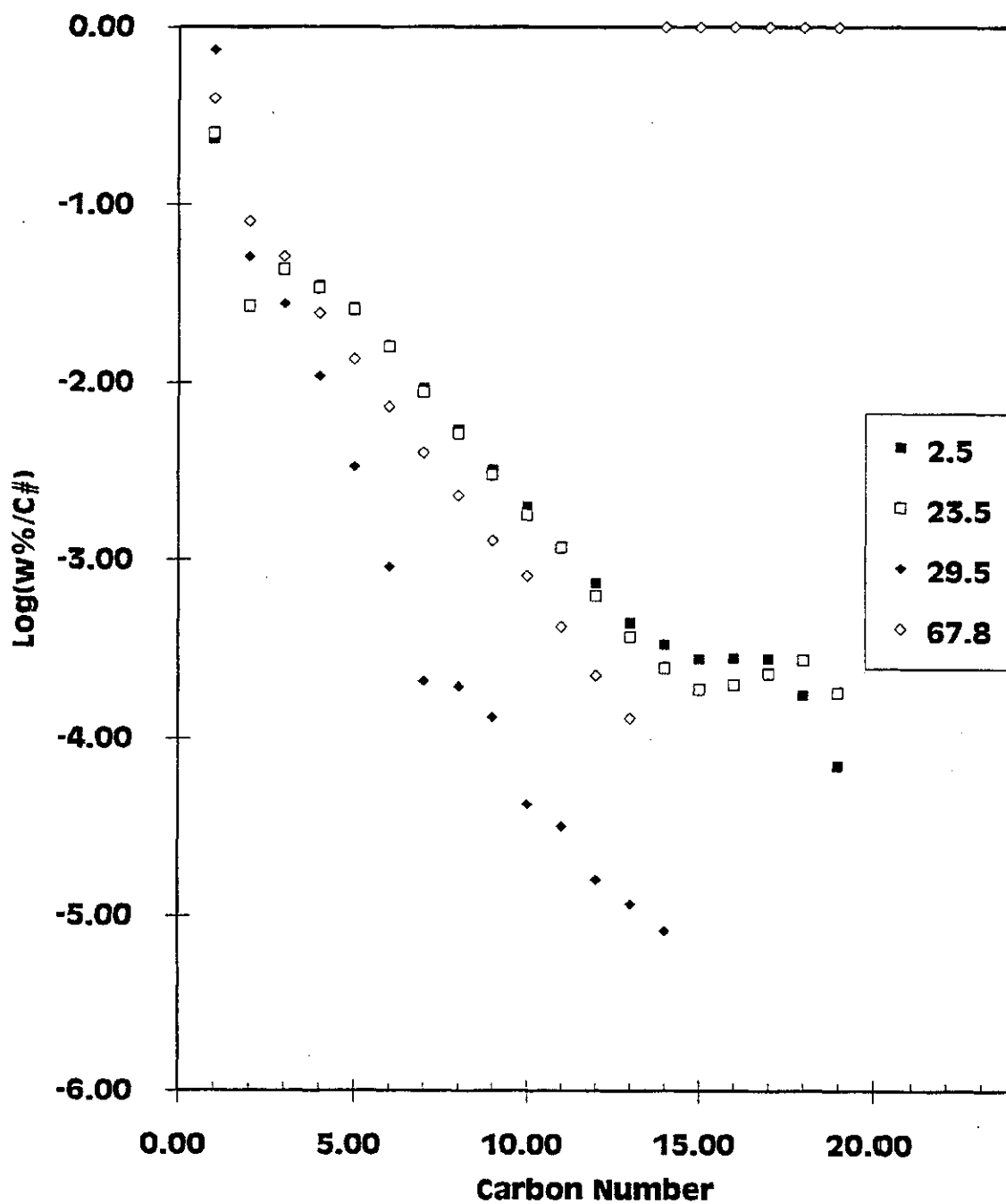
C1	43.90	43.05	42.88	43.27	34.84	0.00
C2	14.78	15.13	15.61	16.11	19.21	0.00
C3	14.83	14.98	15.06	15.29	14.10	0.00
C4	9.01	9.04	9.14	9.13	14.42	0.00
C5	6.54	6.49	6.68	6.55	10.03	0.00
C6	3.97	4.06	2.98	2.14	2.36	0.00
C7	2.66	2.69	2.77	2.79	2.02	0.00
C8	1.79	1.80	1.90	1.84	1.29	0.00
C9	1.08	1.09	1.15	1.16	0.93	0.00
C10	0.70	0.75	0.77	0.81	0.79	0.00
C11	0.46	0.48	0.42	0.47	0.00	0.00
C12	0.28	0.29	0.34	0.27	0.00	0.00
C13	0.00	0.14	0.17	0.17	0.00	0.00
C14	0.00	0.00	0.13	0.00	0.00	0.00
C15	0.00	0.00	0.00	0.00	0.00	0.00
alpha chain growth probability	0.56	0.56	0.57	0.56	0.54	0.00

C1 - C50 estimated total product distribution, weight %

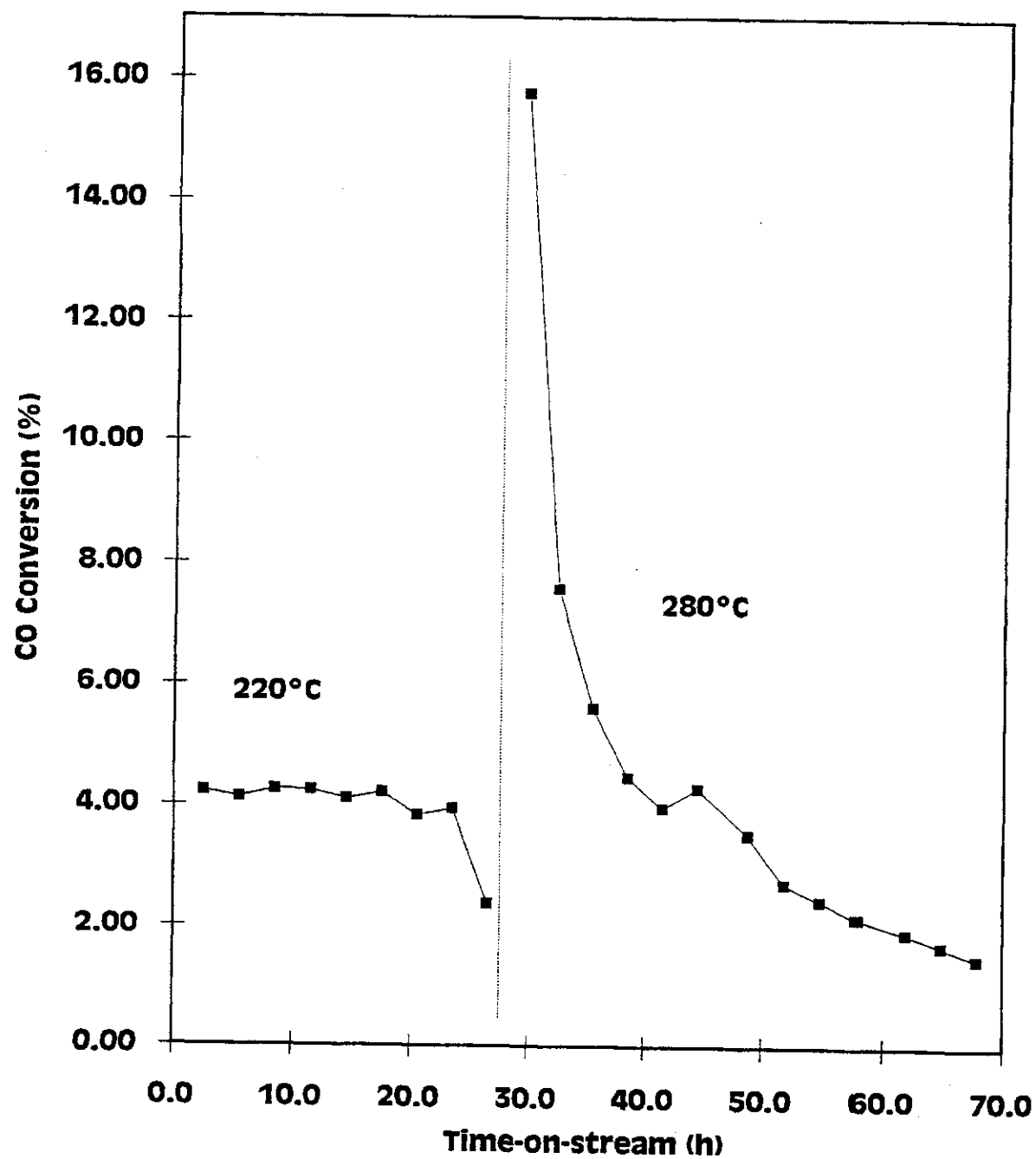
C1	43.7	42.9	42.7	43.2	34.5	0.0
C2 - C4	38.5	39.0	39.7	40.4	47.2	0.0
C5 - C12	17.4	17.6	17.1	16.0	18.0	0.0
C13 - C50	0.4	0.4	0.5	0.4	0.4	0.0

CO conversion, %	2.2	1.9	1.7	1.5	0.2	0.0
rate, g CH ₂ /g cat/hr	0.12	0.11	0.10	0.08	0.01	0.00
CO ₂ formation, %						

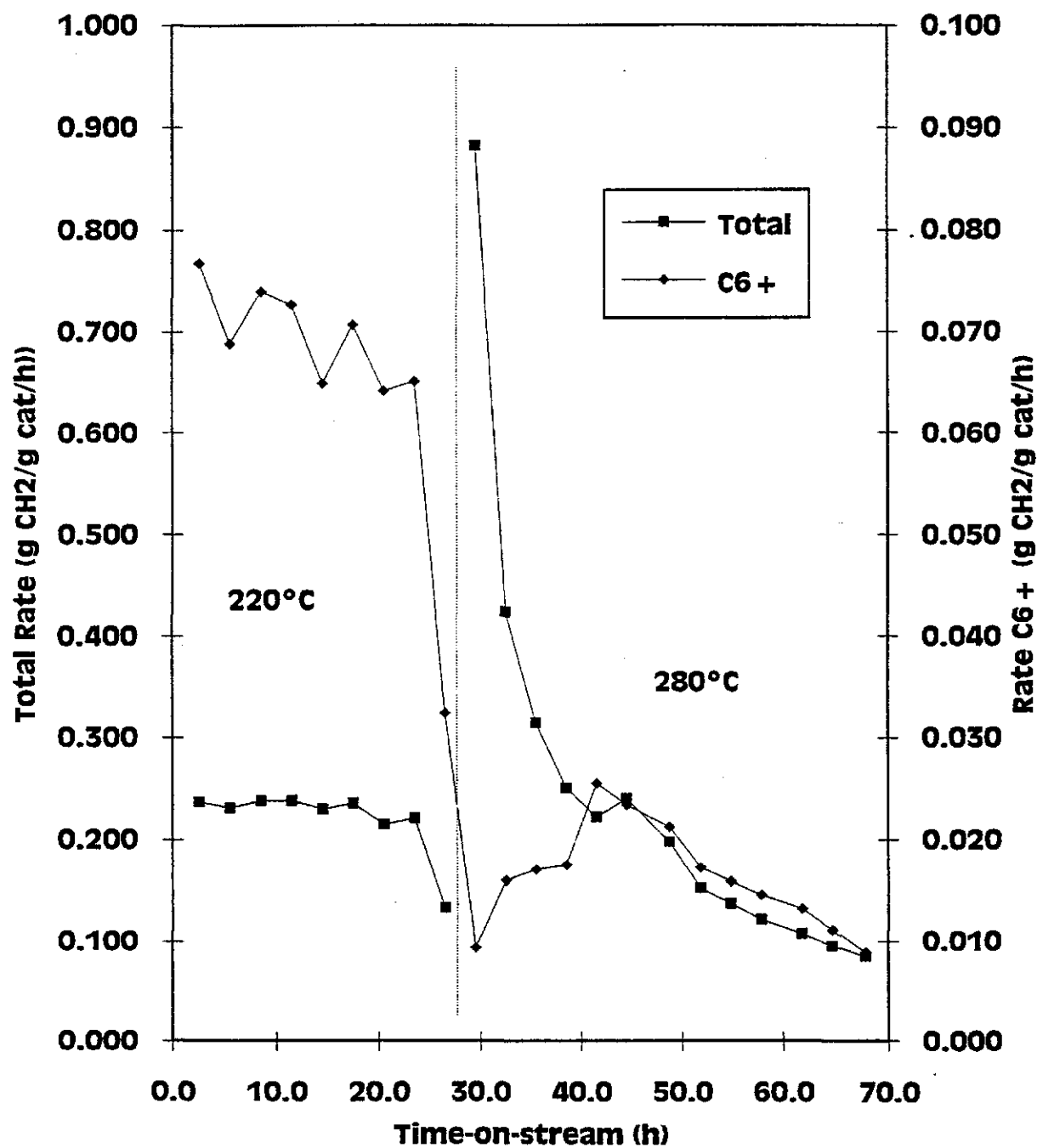
CO Hydrogenation on Co.068 - ASF Product Distribution



CO Hydrogenation on Co.068



CO Hydrogenation on Co.068



CoW.05 - Run #X

Co wt%	NM wt %	Promotor wt%		Support
20		Cu 5.00	Cr 4.00	Al2O3

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.400 g

WHSV = 6.43 1/hr

time on stream = 26.5 hrs

CO₂ (% of CO) =

O/P = 0

0.00

CO conversion (%)	0.8
rate (g CH ₂ /g cat/hr)	0.02
alpha	0.64
C1 (wt%)	32.8
C2 - C4 (wt%)	37.8
C5 - C12 (wt%)	26.7
C13 + (wt%)	2.6

Performance of CoW.05

Dates: 06/01/95 - 06/04/95 Run #X

flow rate = 90.0 cc/min, loading = 0.4 g, WHSV = 6.4 1/hr, H₂/CO ratio in feed = 2.

time on stream, hr	2.5	5.5	8.5	11.5	17.5	20.5
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	35.75	35.98	35.97	36.19	31.50	30.44
C2	10.52	10.71	10.86	10.95	10.16	9.90
C3	15.84	16.01	16.01	16.20	14.42	13.77
C4	12.82	12.62	12.59	12.76	11.92	11.52
C5	9.59	9.40	9.38	9.30	9.49	8.98
C6	5.43	5.35	5.25	5.24	5.57	5.41
C7	3.49	3.24	3.22	3.22	3.77	3.63
C8	2.12	1.94	1.97	1.79	2.50	2.30
C9	1.24	1.13	1.15	1.11	1.88	1.73
C10	0.81	0.75	0.74	0.68	1.48	1.37
C11	0.57	0.49	0.51	0.46	1.14	1.10
C12	0.44	0.33	0.29	0.26	0.80	0.81
C13	0.27	0.24	0.24	0.23	0.69	0.66
C14	0.26	0.21	0.20	0.19	0.62	0.64
C15	0.41	0.26	0.24	0.23	0.75	0.77
alpha chain growth probability	0.59	0.57	0.58	0.57	0.65	0.66

C1 - C50 estimated total product distribution, weight %

C1	35.6	36.3	36.2	36.4	31.9	32.0
C2 - C4	39.0	39.7	39.7	40.1	37.0	37.0
C5 - C12	24.2	23.2	23.2	22.7	28.1	27.8
C13 - C50	1.1	0.7	0.9	0.8	2.9	3.2

CO conversion, %	1.2	1.1	1.0	1.0	0.8	0.8
rate, g CH ₂ /g cat/hr	0.03	0.03	0.03	0.03	0.02	0.02
CO ₂ formation, %						

Performance of CoW.05

Dates: 06/01/95 - 06/04/95 Run #X

flow rate = 90.0 cc/min, loading = 0.4 g, WHSV = 6.4 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	23.5	26.5	32.5	35.5	38.5	41.5
reaction temperature, °C	220	220	220	220	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	30.56	31.24	33.31	34.87	70.69	63.71
C2	10.09	10.18	10.65	11.15	10.68	10.73
C3	14.08	14.16	14.79	15.46	9.36	11.81
C4	11.54	11.69	11.36	11.93	4.49	5.75
C5	8.89	8.99	8.58	8.99	2.21	2.88
C6	5.56	5.08	4.98	4.81	0.86	1.27
C7	3.48	3.57	3.22	3.27	0.52	1.14
C8	2.22	2.22	1.90	2.03	0.36	0.70
C9	1.63	1.61	1.42	1.50	0.23	0.43
C10	1.17	1.22	1.04	1.06	0.12	0.26
C11	1.00	0.99	0.82	0.90	0.09	0.15
C12	0.69	0.66	0.50	0.53	0.04	0.10
C13	0.59	0.55	0.41	0.44	0.04	0.07
C14	0.55	0.55	0.41	0.43	0.03	0.06
C15	0.80	0.69	0.52	0.55	0.03	0.07
alpha chain growth probability	0.64	0.64	0.63	0.63	0.53	0.56

C1 - C50 estimated total product distribution, weight %

C1	32.3	32.8	34.9	35.1	70.7	64.1
C2 - C4	37.8	37.8	38.6	38.8	24.6	28.5
C5 - C12	27.2	26.7	24.5	24.1	4.6	7.2
C13 - C50	2.7	2.6	2.0	1.9	0.1	0.3

CO conversion, %	0.7	0.8	0.8	0.8	10.2	7.5
rate, g CH ₂ /g cat/hr	0.02	0.02	0.02	0.02	0.29	0.21
CO ₂ formation, %						

Performance of CoW.05
 Dates: 06/01/95 - 06/04/95 Run #X

flow rate = 90.0 cc/min, loading = 0.4 g, WHSV = 6.4 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	47.5	50.5	53.5	56.5	59.5	62.5
reaction temperature, °C	280	280	280	280	280	280
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

C1	61.52	59.48	58.17	56.66	55.71	54.63
C2	11.20	11.49	11.81	12.08	12.34	12.52
C3	13.07	13.66	13.88	14.04	14.11	14.05
C4	6.37	6.61	6.77	6.92	7.02	7.06
C5	3.32	3.59	3.76	3.96	4.07	4.18
C6	1.59	1.78	1.88	2.04	2.05	2.49
C7	0.89	1.01	1.06	1.27	1.30	1.38
C8	0.52	0.63	0.66	0.74	0.79	0.87
C9	0.32	0.37	0.42	0.45	0.50	0.55
C10	0.18	0.21	0.24	0.26	0.29	0.32
C11	0.12	0.17	0.17	0.15	0.18	0.21
C12	0.07	0.09	0.10	0.10	0.14	0.16
C13	0.07	0.07	0.08	0.09	0.10	0.12
C14	0.05	0.06	0.07	0.08	0.09	0.10
C15	0.06	0.07	0.08	0.09	0.10	0.11
alpha chain growth probability	0.54	0.52	0.55	0.56	0.56	0.57

C1 - C50 estimated total product distribution, weight %

C1	61.8	59.9	58.5	57.1	56.2	55.1
C2 - C4	30.8	32.0	32.6	33.3	33.8	33.9
C5 - C12	7.3	8.0	8.6	9.3	9.7	10.5
C13 - C50	0.2	0.2	0.3	0.3	0.4	0.4

CO conversion, %	6.1	5.4	4.9	4.4	4.1	3.8
rate, g CH ₂ /g cat/hr	0.17	0.15	0.14	0.12	0.11	0.11
CO ₂ formation, %						

Performance of CoW.05 Dates: 06/01/95 - 06/04/95 Run #X

flow rate = 90.0 cc/min, loading = 0.4 g, WHSV = 6.4 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	65.5	68.5	71.5	74.5	77.5	80.5
reaction temperature, °C	280	280	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0	120.0	120.0	120.0

C1 - C15 product distribution, weight %

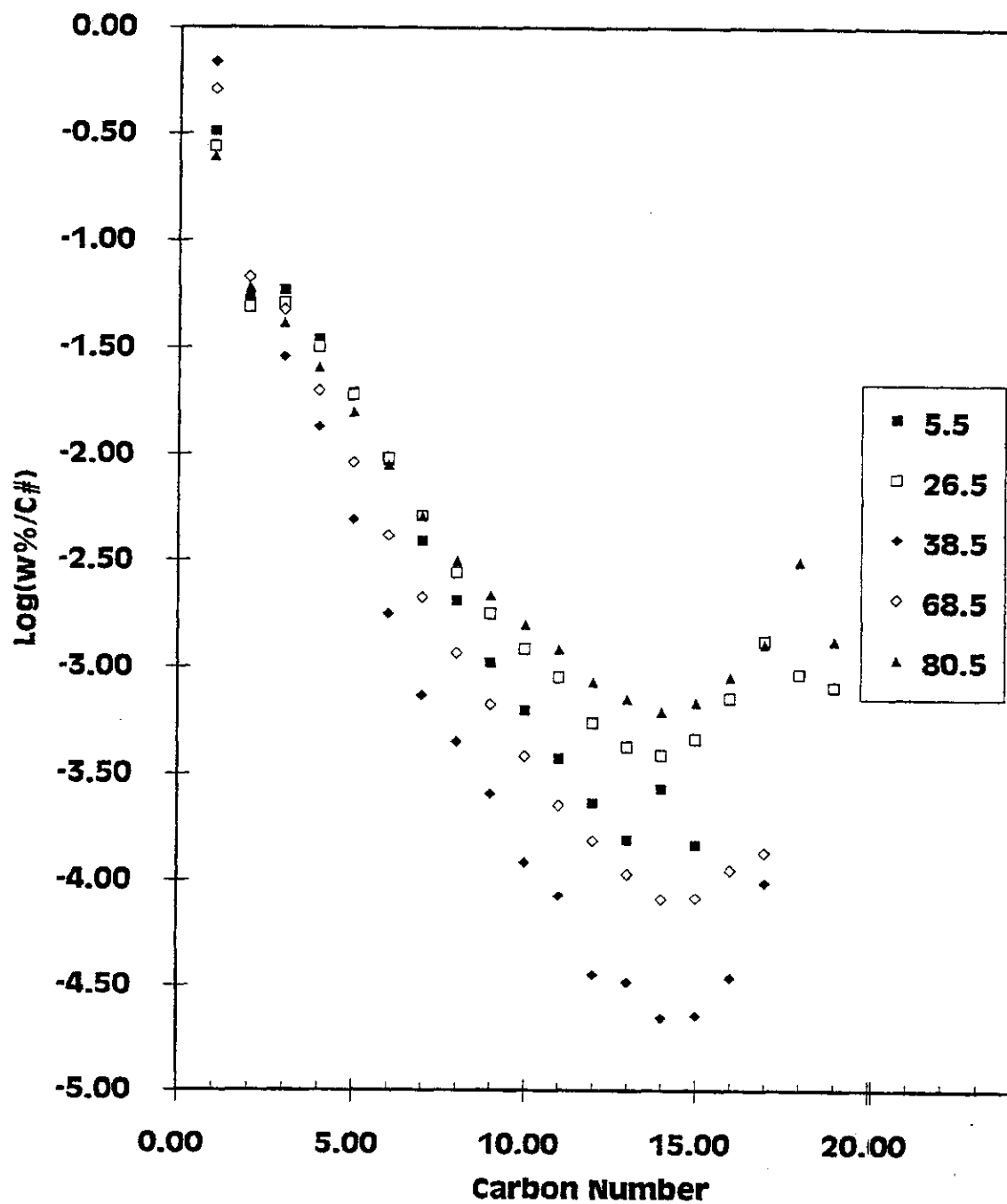
C1	53.77	53.75	29.67	28.28	28.48	28.36
C2	12.70	12.95	13.24	12.64	12.67	12.71
C3	14.02	14.11	12.76	12.18	12.26	12.39
C4	7.15	7.23	10.01	9.69	9.94	9.73
C5	4.29	4.35	6.92	7.69	7.80	7.82
C6	2.59	2.20	2.51	2.26	2.29	2.29
C7	1.48	1.49	3.17	3.48	3.53	3.57
C8	0.93	0.94	2.36	2.54	2.53	2.51
C9	0.60	0.60	1.91	2.13	2.00	1.97
C10	0.38	0.38	1.53	1.67	1.66	1.59
C11	0.26	0.25	1.32	1.44	1.35	1.35
C12	0.17	0.19	0.98	1.27	1.10	1.03
C13	0.13	0.14	0.91	0.94	0.99	0.93
C14	0.11	0.11	0.85	0.82	0.78	0.88
C15	0.12	0.12	0.96	1.06	0.96	1.03
alpha chain growth probability	0.58	0.58	0.69	0.69	0.68	0.69

C1 - C50 estimated total product distribution, weight %

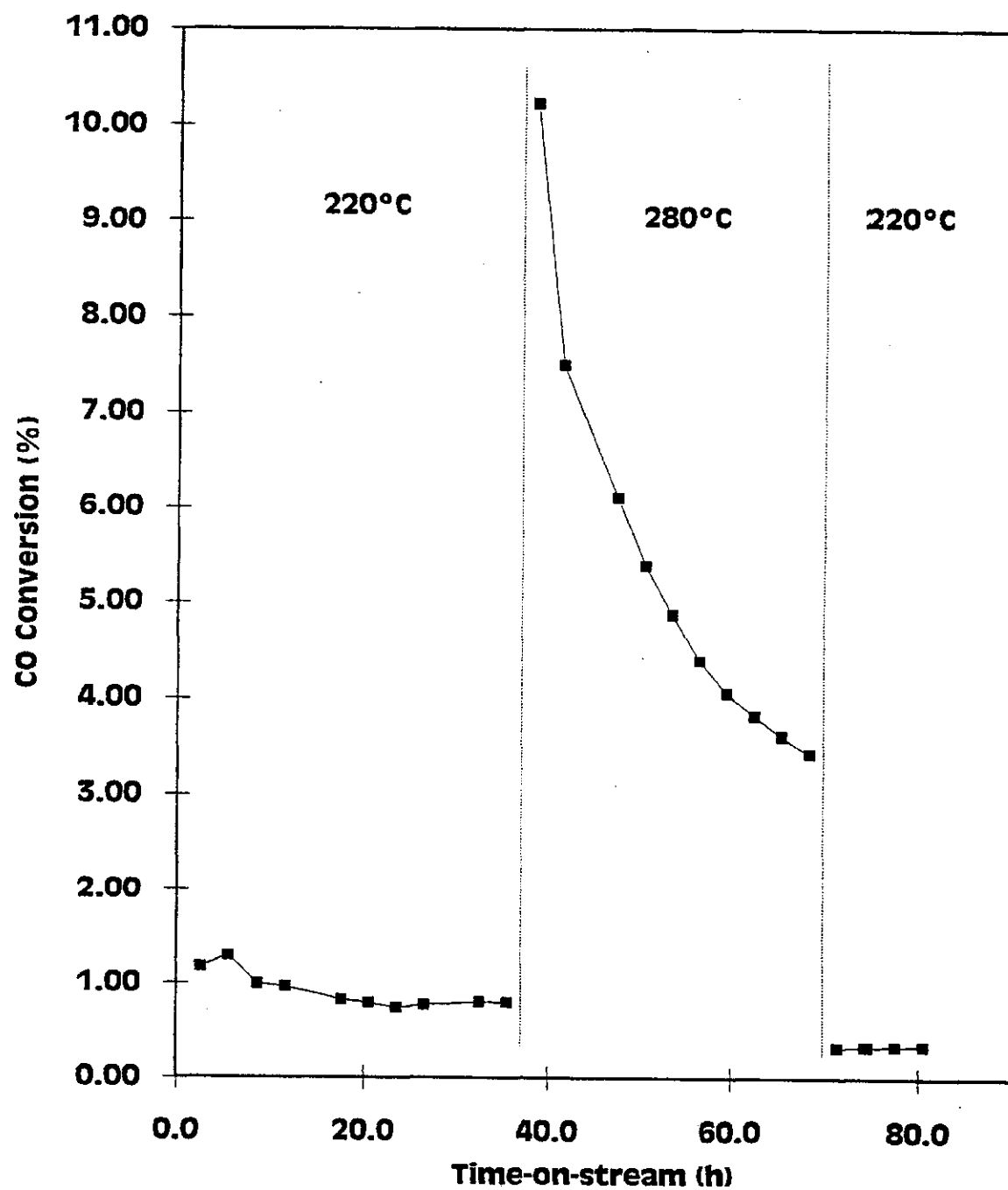
C1	54.3	54.2	32.3	31.4	31.5	31.1
C2 - C4	34.2	34.6	39.2	38.3	38.5	38.2
C5 - C12	11.1	10.8	23.9	25.8	25.6	25.7
C13 - C50	0.5	0.5	4.7	4.6	4.3	4.9

CO conversion, %	3.6	3.4	0.3	0.3	0.3	0.4
rate, g CH ₂ /g cat/hr	0.10	0.10	0.01	0.01	0.01	0.01
CO ₂ formation, %						

CO Hydrogenation on CoW.05 - ASF Product Distribution



CO Hydrogenation on CoW.05



CO Hydrogenation on CoW.05

