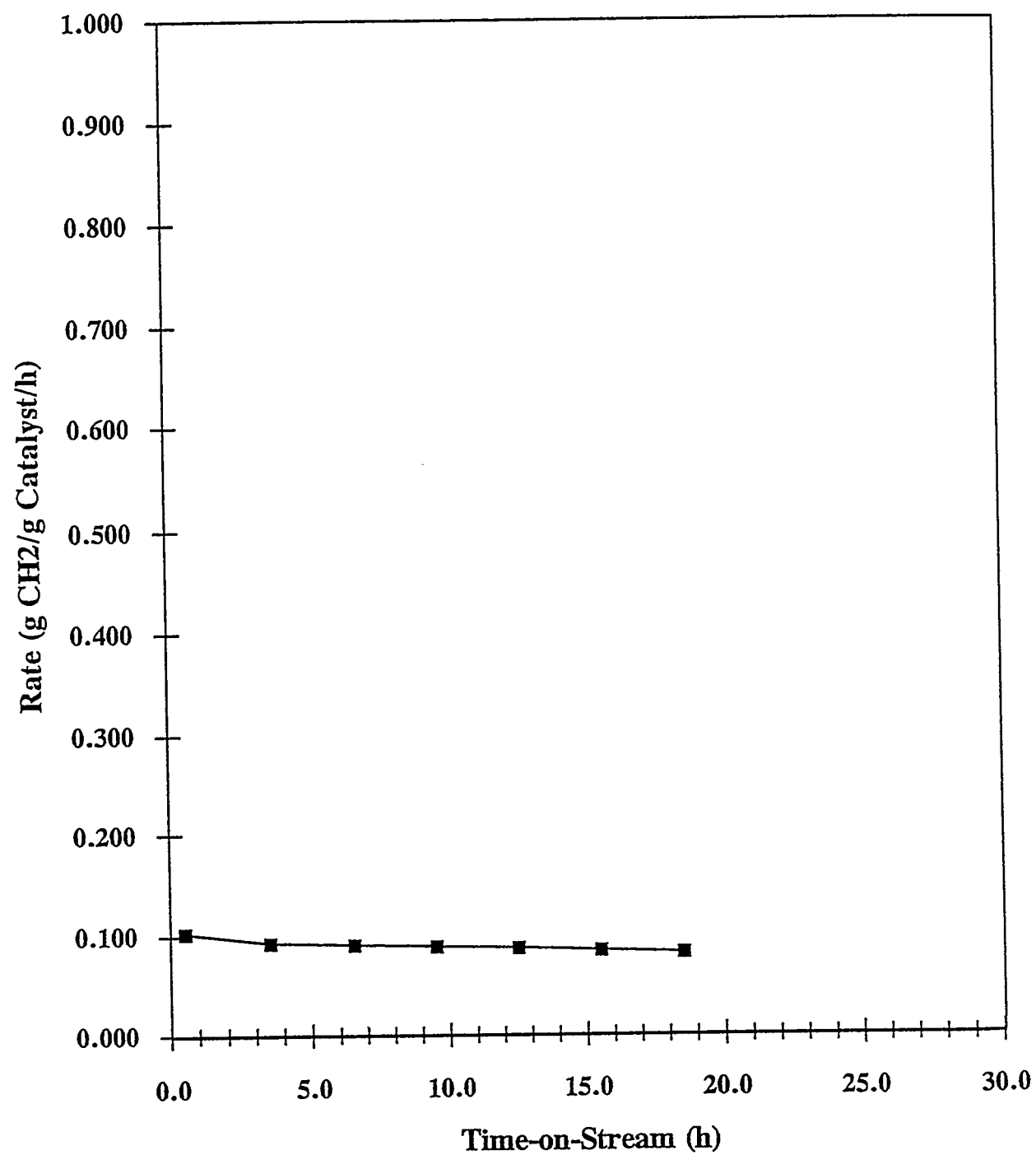
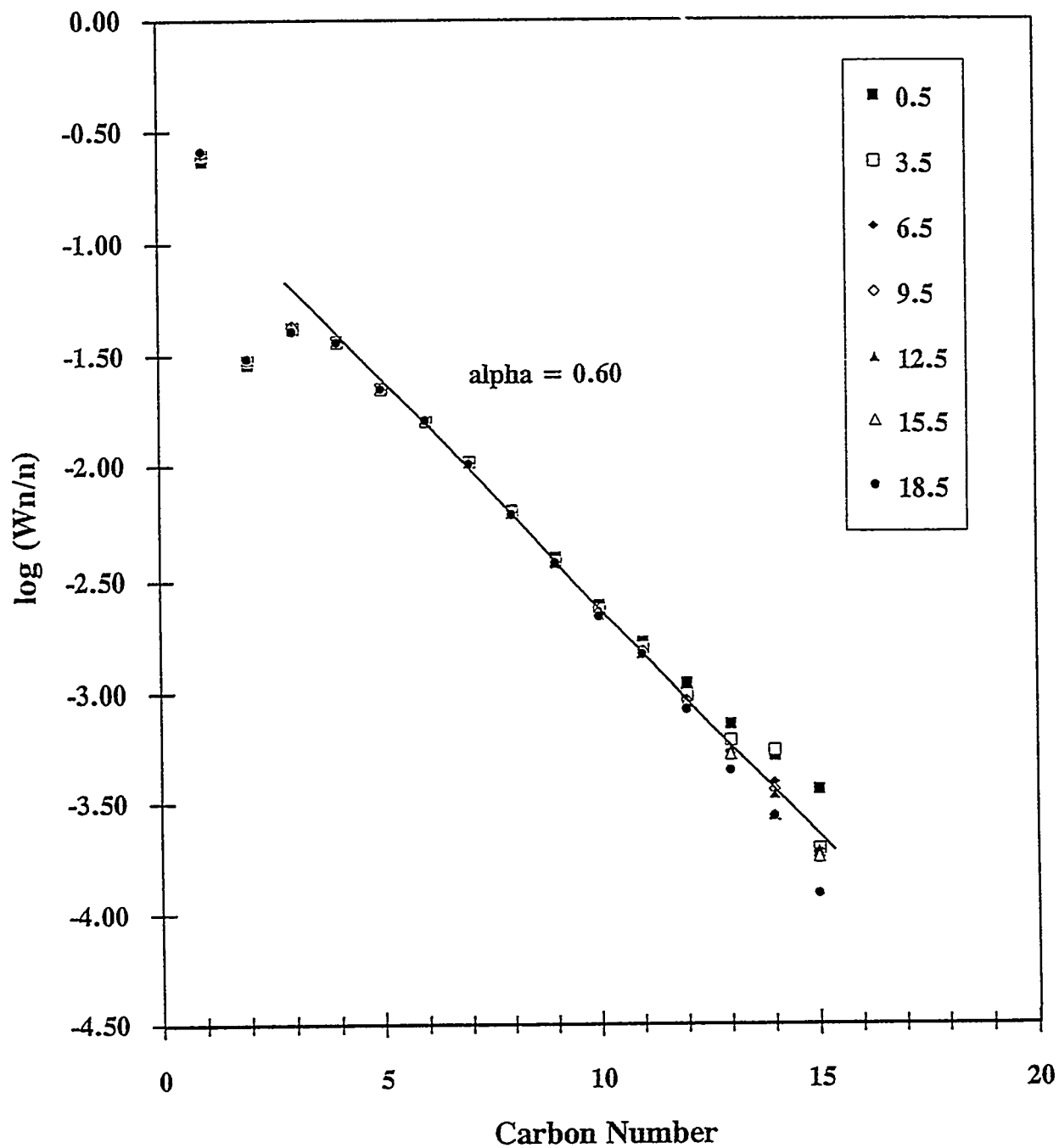


Time-on-Stream Plot for Co.005 - Run #9



Schulz-Flory Plot for Co.005 - Run #9
Time on Stream (hrs)

hrs.



Co.005 - Run #9a

Co wt%	NM wt %	Promotor wt%		Support
20				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) = 0.016CO₂ (% of CO) = 0.1

O/P = 3.14

CO conversion (%)	1.4
rate (g CH ₂ /g cat/hr)	0.07
alpha	0.61
C1 (wt%)	29.9
C2 - C4 (wt%)	32.5
C5 - C12 (wt%)	35.9
C13 + (wt%)	1.7

* 30 cc/min Ar added to the reaction mixture

Co.005 - Run #9b

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

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 280 °C
 H₂/CO = 2
 weight of catalyst = 0.208 g
 WHSV = 12.36 1/hr
 time on stream = 42.5 hrs

CO₂ (g/g cat/hr) = 0.055
 CO₂ (% of CO) = 0.3
 O/P = 5.07

CO conversion (%)	1.4
rate (g CH ₂ /g cat/hr)	0.08
alpha	0.58
C1 (wt%)	62.9
C2 - C4 (wt%)	27.4
C5 - C12 (wt%)	9.2
C13 + (wt%)	0.5

* 30 cc/min Ar added to the reaction mixture

Performance of Co.005

Dates: 03/06/95 - 03/07/95 Run #9b

flow rate = 120.0 cc/min, loading = 0.2 g, WHSV = 12.4 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	21.5	24.5	30.5	33.5	36.5	39.5
reaction temperature, °C	220	220	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	30.55	30.37	68.04	65.68	62.09	59.69
C2	6.85	6.77	7.92	8.82	9.60	10.36
C3	13.78	13.57	11.68	13.90	14.40	14.48
C4	13.08	12.73	6.29	6.50	7.12	7.52
C5	12.01	12.10	3.03	3.19	3.88	4.46
C6	6.22	7.15	1.70	0.40	0.83	1.10
C7	6.77	6.68	0.71	0.87	1.13	1.29
C8	4.25	4.24	0.29	0.31	0.46	0.53
C9	2.68	2.62	0.16	0.13	0.16	0.18
C10	1.63	1.45	0.06	0.01	0.03	0.03
C11	0.92	1.08	0.03	0.04	0.06	0.07
C12	0.39	0.45	0.03	0.04	0.06	0.07
C13	0.28	0.32	0.01	0.04	0.06	0.07
C14	0.31	0.22	0.02	0.04	0.06	0.07
C15	0.28	0.26	0.04	0.04	0.07	0.08
alpha chain growth probability	0.62	0.61	0.55	0.55	0.57	0.58

C1 - C50 estimated total product distribution, weight %

C1	29.9	29.9	67.6	65.3	61.6	59.1
C2 - C4	33.0	32.5	25.7	29.1	30.9	32.1
C5 - C12	35.2	35.9	6.4	5.4	7.1	8.3
C13 - C50	1.8	1.7	0.3	0.3	0.4	0.5

CO conversion, %	1.4	1.4	7.9	4.0	2.6	1.9
rate, g CH ₂ /g cat/hr	0.07	0.07	0.43	0.22	0.14	0.10
CO ₂ formation, %	0.1	0.1	0.6	0.5	0.4	0.3

Performance of Co.005

Dates: 03/06/95 - 03/07/95 Run #9b

flow rate = 120.0 cc/min, loading = 0.2 g, WHSV = 12.4 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	42.5	45.5	48.5
reaction temperature, °C	280	280	280
pressure, atm	1.0	1.0	1.0
flow, cc/min	120.0	120.0	120.0

C1 - C15 product distribution, weight %

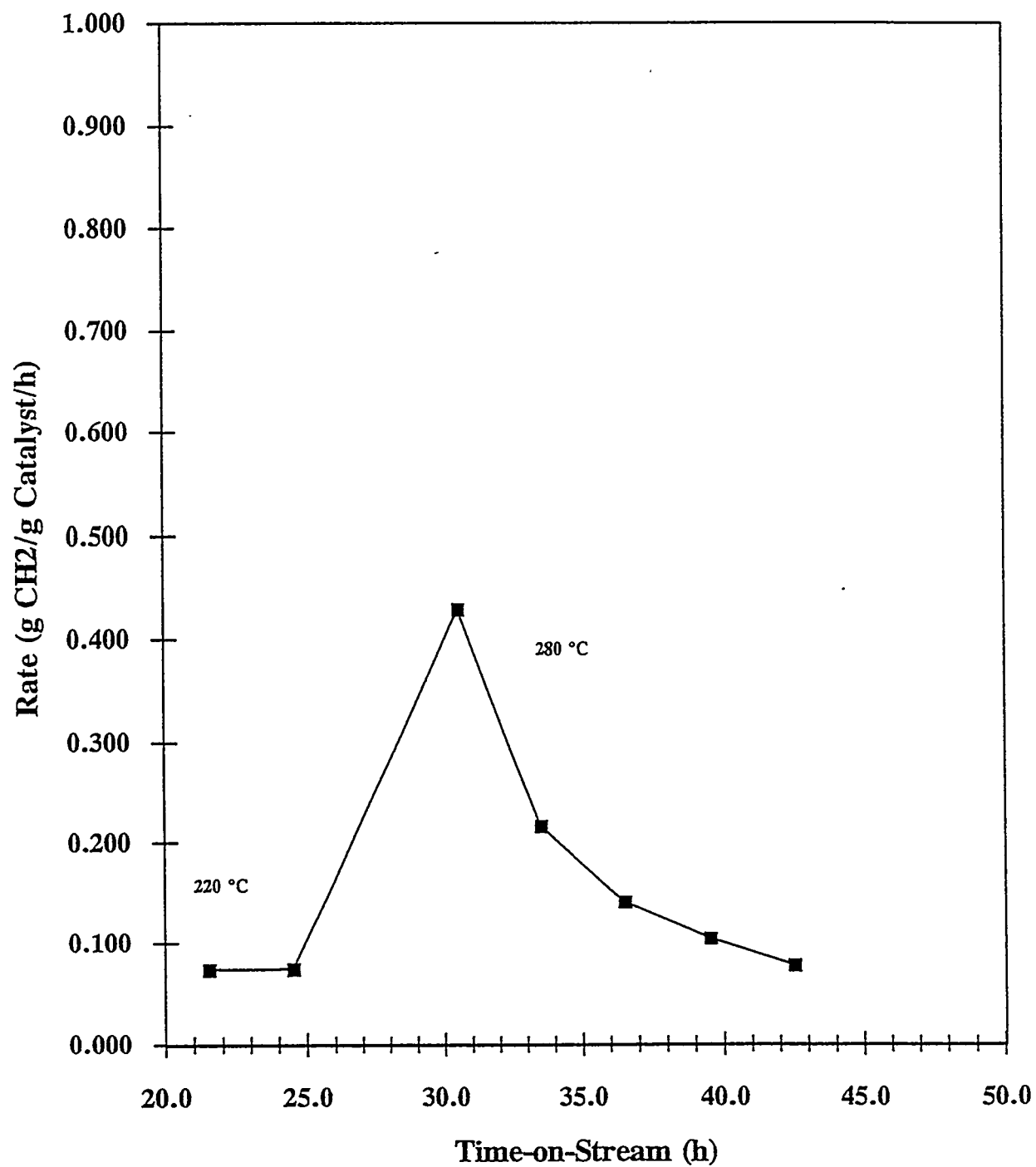
C1	63.57
C2	2.91
C3	16.08
C4	8.65
C5	4.83
C6	1.36
C7	1.40
C8	0.58
C9	0.20
C10	0.03
C11	0.08
C12	0.08
C13	0.08
C14	0.08
C15	0.08
alpha chain growth probability	0.58

C1 - C50 estimated total product distribution, weight %

C1	62.9
C2 - C4	27.4
C5 - C12	9.2
C13 - C50	0.5

CO conversion, %	1.4
rate, g CH ₂ /g cat/hr	0.08
CO ₂ formation, %	0.3

Time-on-Stream Plot for Co.005 - Run #9b



Co.005 - Run #10

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

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.198 g

WHSV = 12.99 1/hr

time on stream = 24.5 hrs

CO₂ (g/g cat/hr) = 0.016CO₂ (% of CO) = 0.1

O/P = 4.13

CO conversion (%)	1.9
rate (g CH ₂ /g cat/hr)	0.11
alpha	0.70
C1 (wt%)	23.0
C2 - C4 (wt%)	25.6
C5 - C12 (wt%)	44.5
C13 + (wt%)	6.9

Performance of Co.005

Dates: 03/08/95 - 03/09/95 Run #10

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 13.0 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	0.5	3.5	6.5	9.5	12.5	24.5
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 %

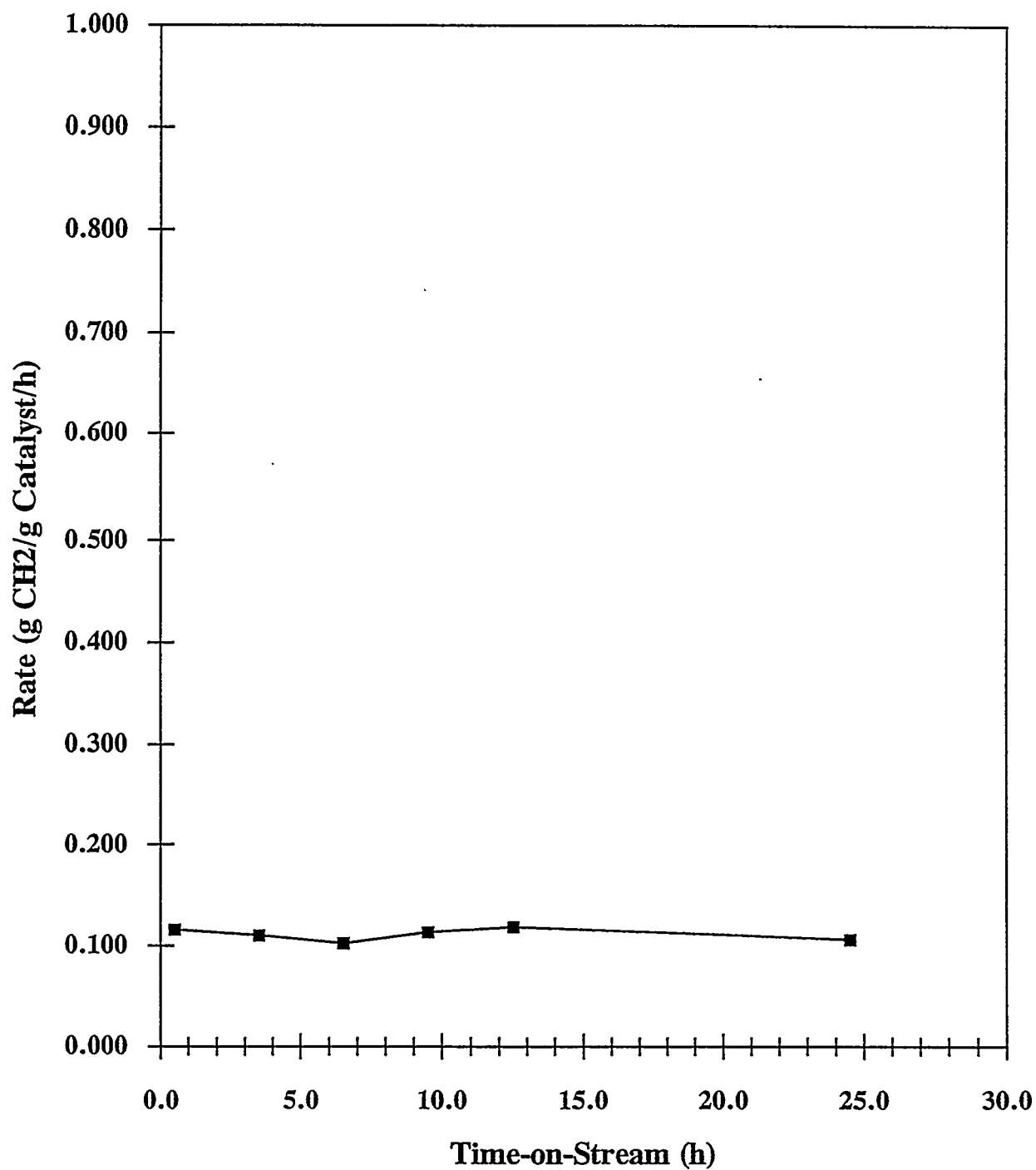
C1	21.43	23.17	23.74	23.67	23.91	24.18
C2	4.97	5.23	5.29	5.26	5.28	5.35
C3	10.81	11.06	10.87	10.57	10.53	10.59
C4	11.53	11.64	11.42	10.99	10.92	10.90
C5	11.86	11.75	11.73	11.40	11.30	11.40
C6	9.75	8.94	8.48	9.21	8.19	9.37
C7	7.72	7.54	7.63	7.47	7.48	7.45
C8	5.86	5.64	5.67	5.65	5.59	5.59
C9	4.74	4.45	4.56	4.28	4.29	4.16
C10	3.40	3.25	3.17	3.49	3.40	3.30
C11	2.73	2.49	2.60	2.53	2.53	2.44
C12	2.10	1.98	2.11	2.00	2.02	1.81
C13	1.47	1.40	1.57	1.55	1.63	1.37
C14	1.04	0.94	1.02	1.17	1.50	1.04
C15	0.58	0.53	0.15	0.76	1.44	1.04
alpha chain growth probability	0.67	0.66	0.59	0.68	0.73	0.70

C1 - C50 estimated total product distribution, weight %

C1	21.5	23.2	25.0	23.3	22.1	23.0
C2 - C4	27.4	28.0	29.0	26.4	24.7	25.6
C5 - C12	47.2	45.2	45.0	45.2	43.6	44.5
C13 - C50	4.0	3.6	1.1	5.1	9.6	6.9

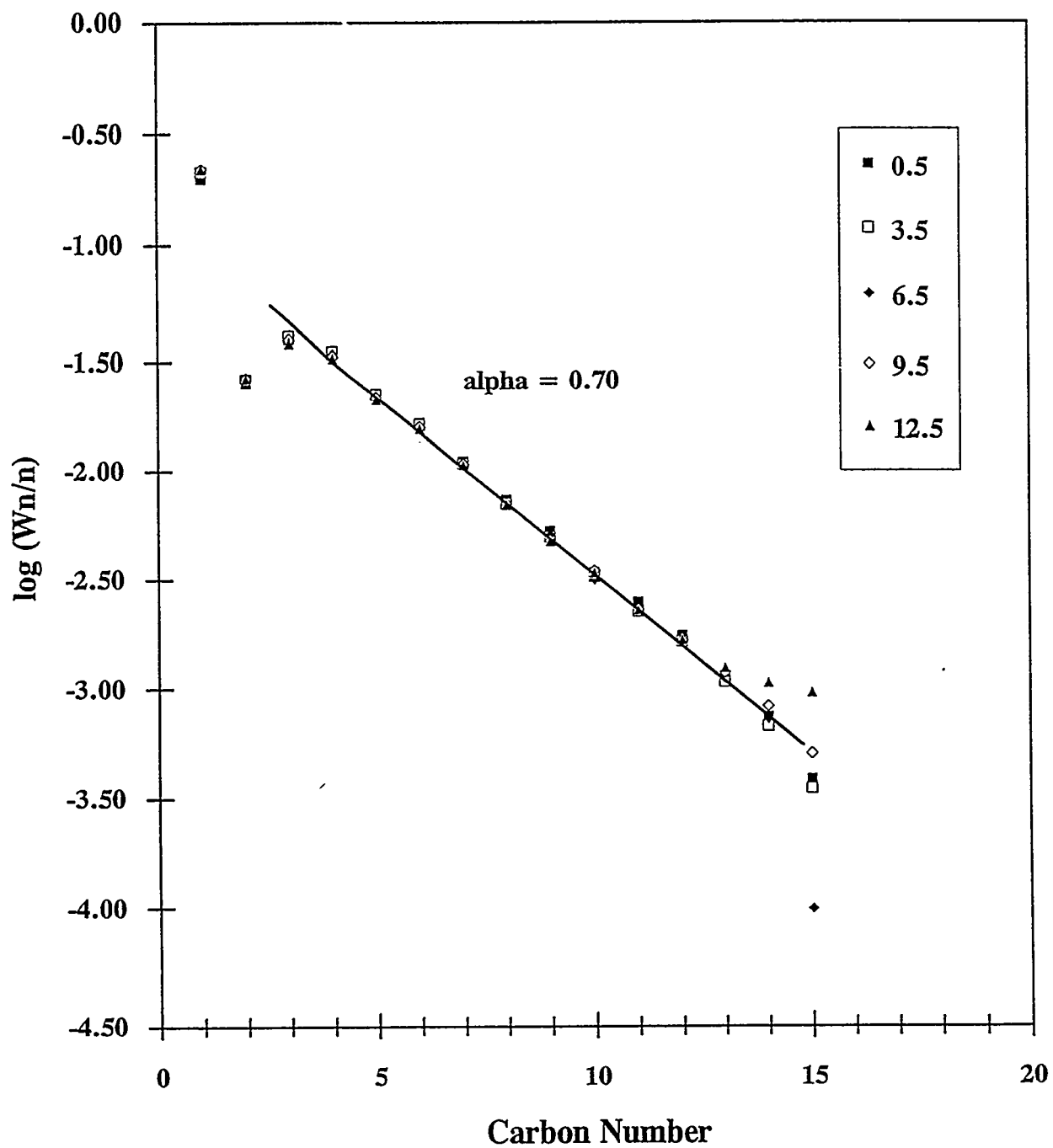
CO conversion, %	2.0	1.9	1.8	2.0	2.1	1.9
rate, g CH ₂ /g cat/hr	0.12	0.11	0.10	0.11	0.12	0.11
CO ₂ formation, %	0.1	0.2	0.1	0.1	0.1	0.1

Time-on-Stream Plot for Co.005 - Run #10



Schulz-Flory Plot for Co.005 - Run #10
Time on Stream (hrs)

hrs.



Co.005 - Run #10a

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

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.198 g

WHSV = 12.99 1/hr

time on stream = 27.5 hrs

CO₂ (g/g cat/hr) = 0.017CO₂ (% of CO) = 0.1

O/P = 4.79

CO conversion (%)	1.6
rate (g CH ₂ /g cat/hr)	0.09
alpha	0.68
C1 (wt%)	25.3
C2 - C4 (wt%)	28.2
C5 - C12 (wt%)	41.8
C13 + (wt%)	4.7

* 30 cc/min Ar added to the reaction mixture

Co.005 - Run #10b

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

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 280 °C

H₂/CO = 2

weight of catalyst = 0.198 g

WHSV = 12.99 1/hr

time on stream = 50.5 hrs

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

O/P = 5.78

CO conversion (%)	1.8
rate (g CH ₂ /g cat/hr)	0.10
alpha	0.65
C1 (wt%)	48.0
C2 - C4 (wt%)	31.9
C5 - C12 (wt%)	18.0
C13 + (wt%)	2.0

* 30 cc/min Ar added to the reaction mixture

Performance of Co.005

Dates: 03/09/95 - 03/10/95 Run #10b

flow rate = 120.0 cc/min, loading = 0.2 g, WHSV = 13.0 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	27.5	33.5	36.5	39.5	45.5	47.5
reaction temperature, °C	220	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	26.12	61.96	61.60	56.71	51.95	50.01
C2	6.07	7.85	8.77	9.57	11.21	11.77
C3	11.62	13.70	14.20	13.90	13.61	13.45
C4	11.43	7.44	6.86	7.33	7.85	8.02
C5	11.12	3.92	3.81	4.55	5.41	5.72
C6	10.09	1.78	0.84	2.41	2.55	2.20
C7	6.85	1.14	1.29	1.76	2.29	2.60
C8	4.86	0.72	0.79	1.11	1.51	1.74
C9	3.49	0.45	0.53	0.80	0.98	1.46
C10	2.41	0.26	0.37	0.53	0.72	0.87
C11	1.84	0.22	0.26	0.39	0.55	0.67
C12	1.50	0.17	0.20	0.29	0.51	0.55
C13	1.03	0.13	0.17	0.25	0.34	0.39
C14	0.84	0.11	0.15	0.22	0.28	0.29
C15	0.72	0.14	0.17	0.19	0.25	0.28
alpha chain growth probability	0.68	0.61	0.62	0.63	0.64	0.64

C1 - C50 estimated total product distribution, weight %

C1	25.3	61.1	60.6	55.9	51.1	49.2
C2 - C4	28.2	28.6	29.3	30.3	32.2	32.7
C5 - C12	41.8	9.4	8.9	12.5	15.1	16.3
C13 - C50	4.7	0.9	1.1	1.3	1.6	1.8

CO conversion, %	1.6	8.7	6.0	4.2	2.6	2.2
rate, g CH ₂ /g cat/hr	0.09	0.50	0.34	0.24	0.15	0.12
CO ₂ formation, %	0.1	0.6	0.5	0.4	0.4	0.2

Performance of Co.005

Dates: 03/09/95 - 03/10/95 Run #10b

flow rate = 120.0 cc/min, loading= 0.2 g, WHSV = 13.0 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	50.5	53.5
reaction temperature, °C	280	220
pressure, atm	1.0	1.0
flow, cc/min	120.0	120.0

C1 - C15 product distribution, weight %

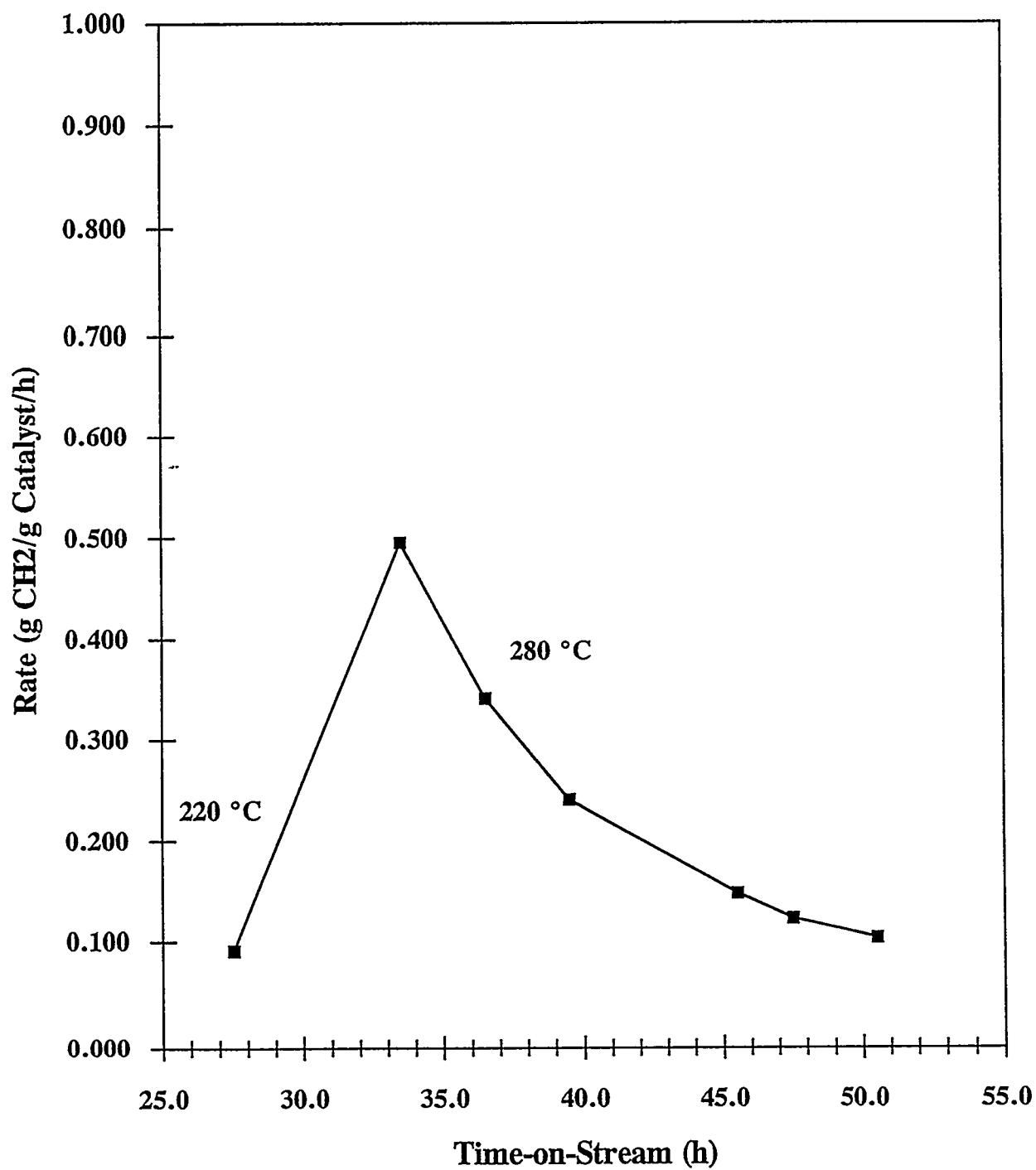
C1	48.74	27.61
C2	10.71	9.44
C3	13.53	9.28
C4	8.18	8.46
C5	5.98	8.65
C6	2.76	2.91
C7	2.82	6.62
C8	1.99	5.18
C9	1.51	4.46
C10	1.05	3.86
C11	0.81	3.44
C12	0.61	3.15
C13	0.57	2.75
C14	0.44	2.48
C15	0.31	1.72
alpha chain growth probability	0.65	0.76

C1 - C50 estimated total product distribution, weight %

C1	48.0	25.9
C2 - C4	31.9	25.5
C5 - C12	18.0	36.2
C13 - C50	2.0	12.4

CO conversion, %	1.8	0.4
rate, g CH ₂ /g cat/hr	0.10	0.02
CO ₂ formation, %	0.2	0.1

Time-on-Stream Plot for Co.005 - Run #10b



Co.005 - Run #10c

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

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.198 g

WHSV = 12.99 1/hr

time on stream = 53.5 hrs

CO₂ (g/g cat/hr) = 0.013CO₂ (% of CO) = 0.1

O/P = 1.98

E_a = 13.8 kcal/mol

CO conversion (%)	0.4
rate (g CH ₂ /g cat/hr)	0.02
alpha	0.76
C1 (wt%)	25.9
C2 - C4 (wt%)	25.5
C5 - C12 (wt%)	36.2
C13 + (wt%)	12.4

* Cooled down to 220 °C after the reaction at 280 °C

Co.053 - Run #7

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 = 227 °C

H₂/CO = 2

weight of catalyst = 0.192 g

WHSV = 13.43 1/hr

time on stream = 24.5 hrs

CO₂ (g/g cat/hr) = 0.044CO₂ (% of CO) = 0.2

O/P = 1.17

CO conversion (%)	9.4
rate (g CH ₂ /g cat/hr)	0.55
alpha	0.60
C1 (wt%)	34.3
C2 - C4 (wt%)	30.1
C5 - C12 (wt%)	34.2
C13 + (wt%)	1.4

Performance of Co.053

Dates: 01/24/95 - 01/25/95 Run #7

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 13.4 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	0.5	3.5	6.5	9.5	12.5	15.5
reaction temperature, °C	227	227	227	227	227	227
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	36.41	36.34	36.40	36.38	35.69	36.08
C2	5.96	5.88	5.84	5.81	5.71	5.74
C3	13.30	13.31	13.34	13.32	13.37	13.36
C4	12.42	12.33	12.35	12.26	12.32	12.15
C5	10.52	10.53	10.56	10.51	10.74	10.60
C6	7.16	7.24	7.23	7.22	7.46	7.37
C7	5.16	5.21	5.60	5.56	5.73	5.67
C8	1.93	3.83	3.46	3.53	3.52	3.55
C9	3.85	2.03	2.04	2.10	2.17	2.12
C10	1.24	1.21	1.28	1.29	1.35	1.33
C11	0.86	0.77	0.74	0.96	0.82	0.93
C12	0.40	0.43	0.40	0.35	0.39	0.41
C13	0.31	0.30	0.27	0.26	0.26	0.25
C14	0.27	0.30	0.24	0.24	0.23	0.22
C15	0.21	0.28	0.25	0.22	0.23	0.21
alpha chain growth probability	0.60	0.62	0.61	0.60	0.61	0.60

C1 - C50 estimated total product distribution, weight %

C1	35.9	35.6	35.7	35.9	35.1	35.6
C2 - C4	31.3	30.8	30.9	30.9	30.9	30.9
C5 - C12	31.4	31.7	31.7	31.7	32.5	32.2
C13 - C50	1.4	1.9	1.6	1.5	1.5	1.4

CO conversion, %	11.0	10.6	9.9	9.6	9.0	9.2
rate, g CH ₂ /g cat/hr	0.64	0.62	0.58	0.57	0.53	0.54
CO ₂ formation, %	0.3	0.3	0.2	0.2	0.2	0.2

Performance of Co.053

Dates: 01/24/95 - 01/25/95 Run #7

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 13.4 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	18.5	21.5	24.5	27.5
reaction temperature, °C	227	227	227	245
pressure, atm	1.0	1.0	1.0	1.0
flow, cc/min	90.0	90.0	90.0	120.0

C1 - C15 product distribution, weight %

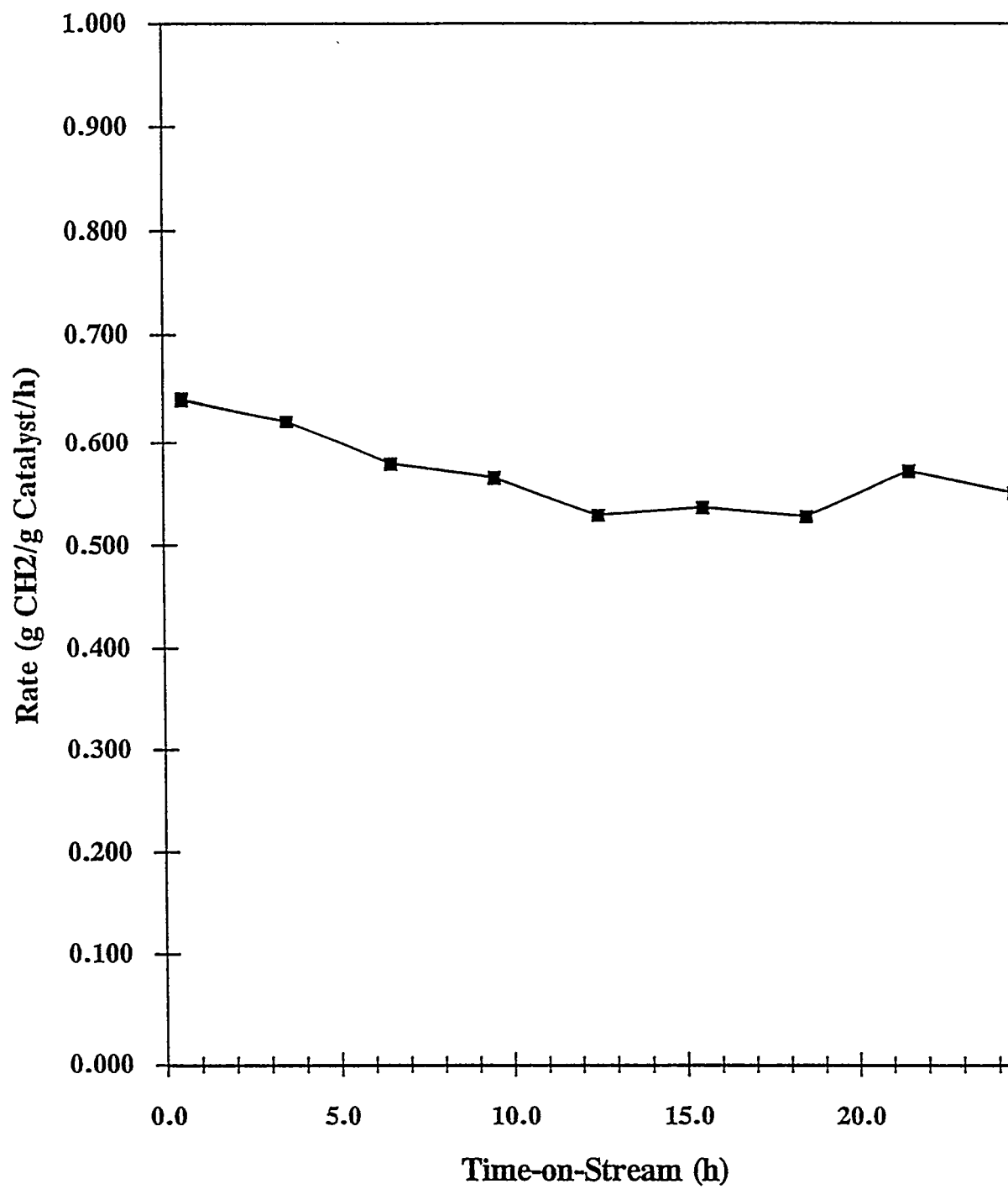
C1	35.76	35.03	34.76	93.12
C2	5.69	5.57	5.53	1.38
C3	13.35	13.09	13.05	1.72
C4	12.22	12.01	11.96	1.29
C5	10.64	10.52	10.45	0.97
C6	7.48	7.49	7.39	0.45
C7	5.71	5.71	6.18	0.42
C8	3.54	3.56	4.41	0.27
C9	2.21	2.24	2.76	0.18
C10	1.35	1.41	1.56	0.07
C11	0.89	0.97	0.90	0.04
C12	0.42	0.45	0.26	0.03
C13	0.26	0.39	0.31	0.02
C14	0.24	0.77	0.27	0.02
C15	0.23	0.78	0.21	0.01
alpha chain growth probability	0.61	0.68	0.60	0.70

C1 - C50 estimated total product distribution, weight %

C1	35.2	32.8	34.3	93.1
C2 - C4	30.8	28.7	30.1	4.4
C5 - C12	32.5	33.4	34.2	2.4
C13 - C50	1.5	5.0	1.4	0.1

CO conversion, %	9.0	9.7	9.4	19.9
rate, g CH ₂ /g cat/hr	0.53	0.57	0.55	1.17
CO ₂ formation, %	0.2	0.2	0.2	13.6

Time-on-Stream Plot for Co053 - Run #7



Co.053 - Run #7a

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 = 245 °C

H₂/CO = 2

weight of catalyst = 0.192 g

WHSV = 13.39 1/hr

time on stream = 42.5 hrs

CO₂ (g/g cat/hr) = 0.028CO₂ (% of CO) = 0.1

O/P = 8.37

CO conversion (%)	1.7
rate (g CH ₂ /g cat/hr)	0.10
alpha	0.60
C1 (wt%)	38.1
C2 - C4 (wt%)	35.7
C5 - C12 (wt%)	24.9
C13 + (wt%)	1.3

* Temperature surge to 285 ° C when it was set at 240 ° C

Performance of Co.053 Dates: 01/24/95 - 01/26/95 Run #7a

flow rate = 120.0 cc/min, loading= 0.2 g, WHSV = 13.4 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	27.5	30.5	33.5	36.5	39.5	42.5
reaction temperature, °C	245	245	245	245	245	245
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	93.16	37.63	37.80	38.18	35.78	38.50
C2	1.38	9.27	9.37	9.52	8.94	9.69
C3	1.72	15.86	15.44	15.26	13.98	14.92
C4	1.29	12.39	11.96	11.80	18.01	11.55
C5	0.97	9.48	9.85	9.74	8.90	9.55
C6	0.45	4.39	4.21	4.25	3.98	4.46
C7	0.40	4.10	4.15	4.19	3.84	4.20
C8	0.26	2.87	3.06	3.07	2.74	2.84
C9	0.18	2.12	1.68	1.42	1.55	1.64
C10	0.06	0.64	0.71	0.71	0.67	0.75
C11	0.04	0.31	0.69	0.72	0.59	0.74
C12	0.03	0.28	0.33	0.43	0.39	0.44
C13	0.02	0.23	0.30	0.30	0.27	0.31
C14	0.02	0.21	0.23	0.21	0.19	0.20
C15	0.01	0.21	0.22	0.20	0.17	0.19
alpha chain growth probability	0.70	0.61	0.61	0.61	0.60	0.60

C1 - C50 estimated total product distribution, weight %

C1	93.1	36.9	37.2	37.7	35.4	38.1
C2 - C4	4.4	36.8	36.2	36.1	40.5	35.7
C5 - C12	2.4	25.0	25.2	24.9	23.0	24.9
C13 - C50	0.1	1.4	1.4	1.3	1.1	1.3

CO conversion, %	19.9	1.9	1.8	1.8	1.9	1.7
rate, g CH ₂ /g cat/hr	1.16	0.11	0.11	0.10	0.11	0.10
CO ₂ formation, %	13.6	0.3	0.2	0.1	0.2	0.1

Performance of Co.053

Dates: 01/24/95 - 01/26/95 Run #7a

flow rate = 120.0 cc/min, loading = 0.2 g, WHSV = 13.4 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	45.5	48.5	51.5	60.5	63.5	66.5
reaction temperature, °C	265	265	285	285	285	305
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	43.40	43.27	44.43	42.94	44.55	45.14
C2	9.71	10.60	12.32	17.99	18.35	18.94
C3	16.70	16.05	16.89	16.22	16.00	16.13
C4	11.23	10.78	9.99	9.19	8.96	8.15
C5	8.16	7.95	6.86	5.52	5.20	4.64
C6	2.80	3.31	2.76	2.76	2.40	1.66
C7	3.25	3.18	2.68	2.17	1.82	2.23
C8	2.29	2.15	1.74	1.48	1.34	1.43
C9	1.09	1.09	1.10	0.63	0.49	0.73
C10	0.64	0.49	0.73	0.37	0.26	0.38
C11	0.38	0.37	0.16	0.17	0.15	0.07
C12	0.16	0.30	0.12	0.12	0.11	0.08
C13	0.06	0.19	0.07	0.12	0.11	0.23
C14	0.06	0.15	0.08	0.11	0.09	0.12
C15	0.07	0.11	0.08	0.19	0.18	0.09
alpha chain growth probability	0.55	0.58	0.56	0.62	0.61	0.59

C1 - C50 estimated total product distribution, weight %

C1	43.1	42.9	44.0	42.0	43.6	44.8
C2 - C4	37.4	37.1	38.8	42.5	42.4	42.8
C5 - C12	19.0	19.2	16.6	14.2	12.8	11.8
C13 - C50	0.5	0.8	0.5	1.3	1.2	0.6

CO conversion, %	4.8	3.2	4.6	1.2	1.0	24.9
rate, g CH ₂ /g cat/hr	0.28	0.19	0.27	0.07	0.06	0.10
CO ₂ formation, %	0.4	0.3	0.5	0.3	0.2	1.2

Time-on-Stream Plot for Co053 - Run #7a

