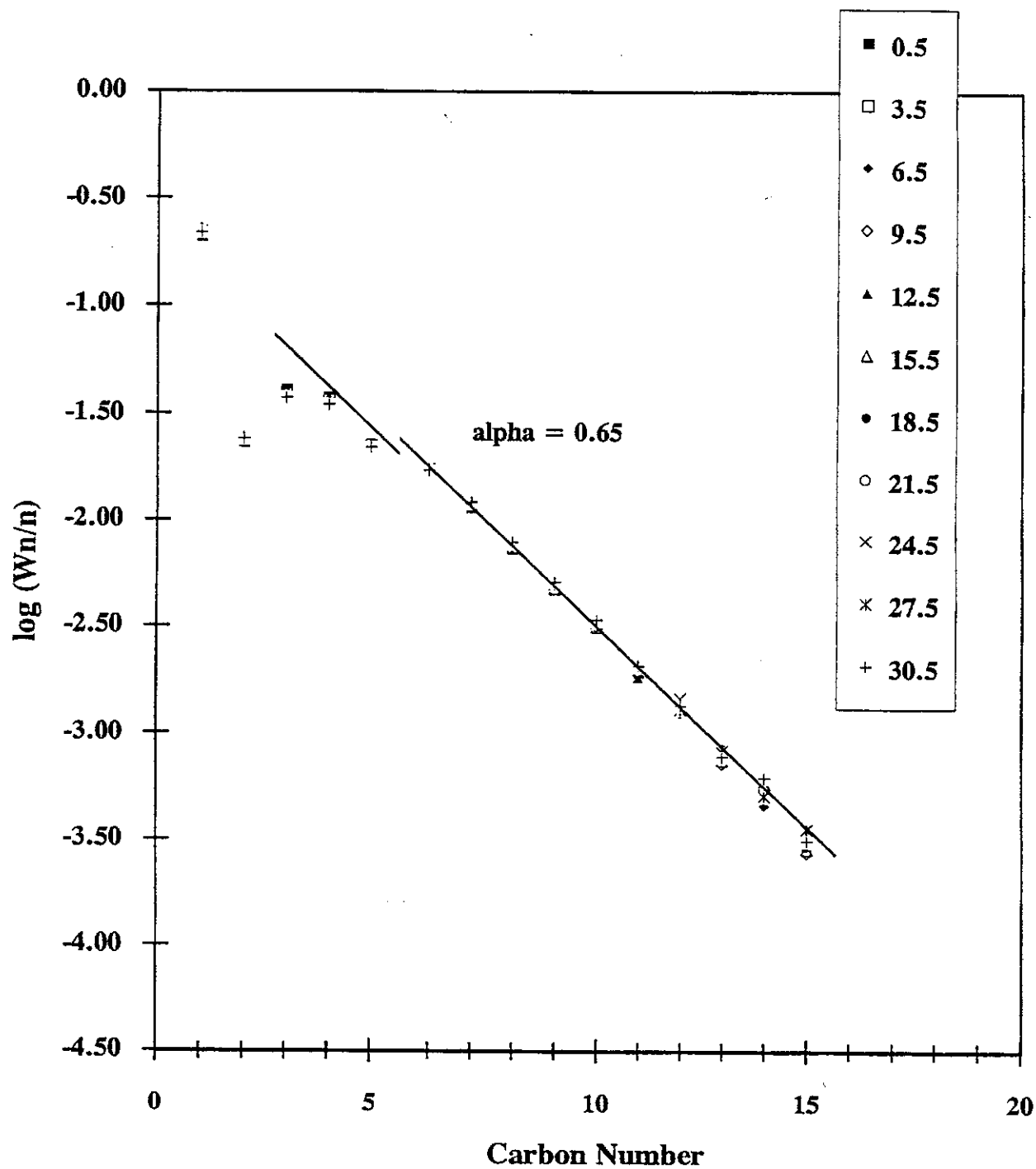


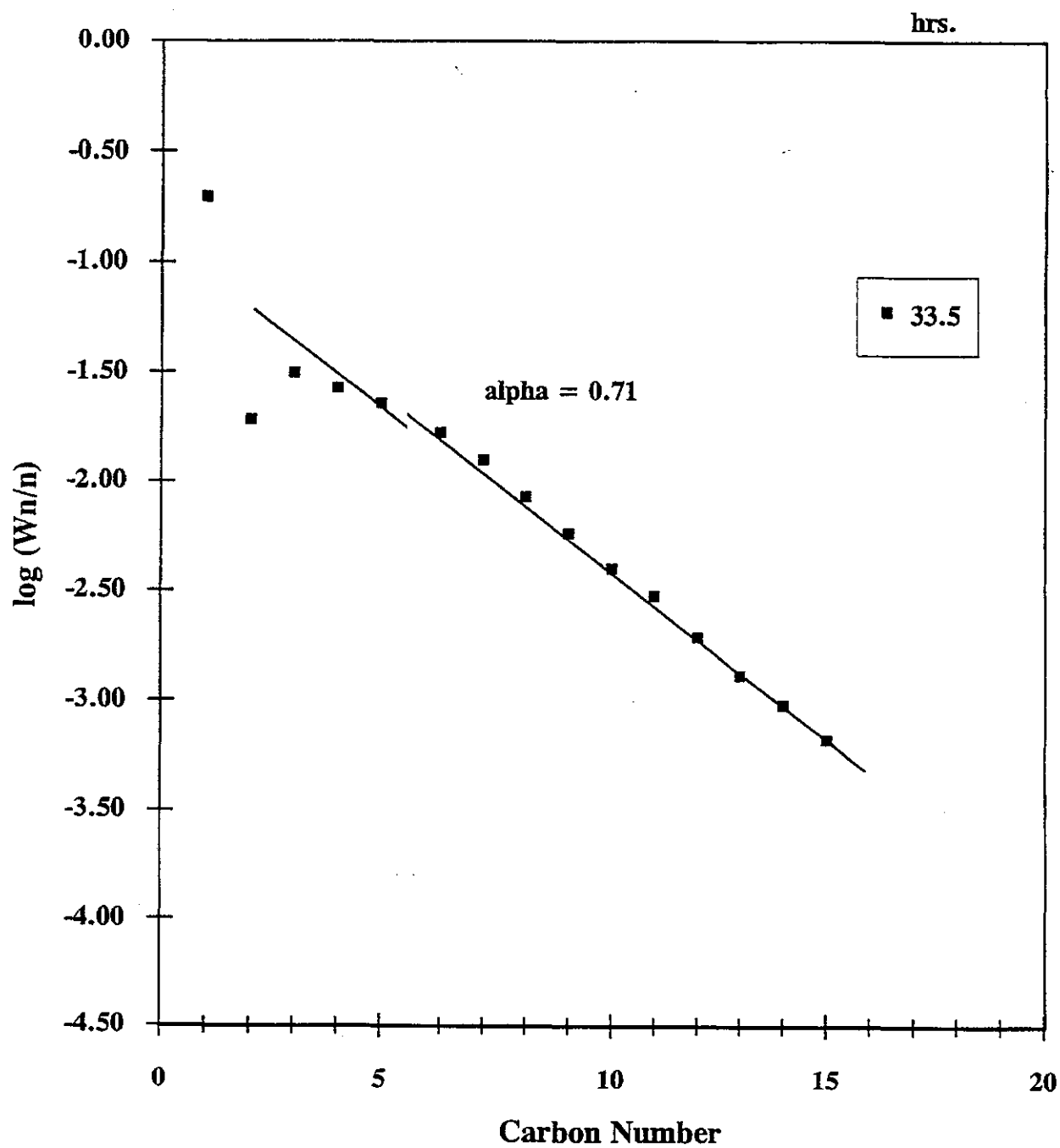
Schulz-Flory Plot for Co.027 - Run #1

Time on Stream (hrs)

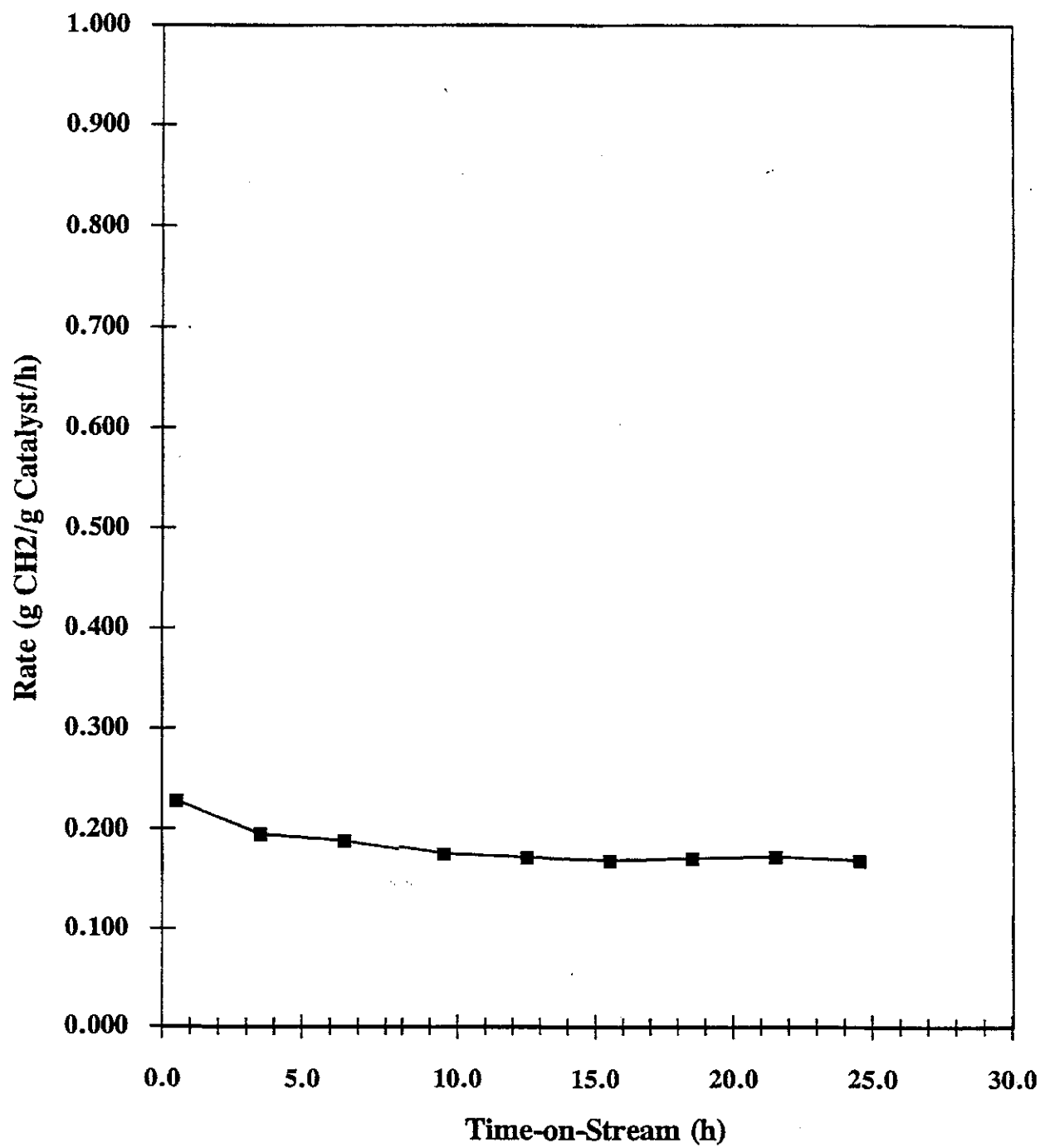
hrs.



Schulz-Flory Plot for Co.027 - Run #1
High Conversion Study



Time-on-Stream Plot for Co.027 - Run #1



Co.028 - Run #3 (re-calcine in flow air)

Co wt%	NM wt %	Promotor wt%		Support
20	Ru 0.500	K 0.50		Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm

T = 220 °C

H₂/CO = 2

weight of catalyst = 0.249 g

WHSV = 100.34 1/hr

time on stream = 26.0 hrs

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

O/P = 13.49

CO conversion (%)	4.5
rate (g CH ₂ /g cat/hr)	0.21
alpha	0.79
C1 (wt%)	15.5
C2 - C4 (wt%)	16.8
C5 - C12 (wt%)	47.2
C13 + (wt%)	20.5

Performance of Co.028

Dates: 04/18/94 - - 04/19/94 Run #3 (re-calcine in flow air)

flow rate = 90.0 cc/min, loading = 0.0.2 g, WHSV = 10.3 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	0.5	2.5	5.0	8.0	24.0	26.0
reaction temperature, °C	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1	1
flow, cc/min	90.0	90.0	90.0	90.0	90.0	90.0

C1 - C15 product distribution, weight %

C1	16.80	16.95	16.99	16.92	17.21	17.79
C2	3.21	3.24	3.69	3.79	3.35	3.72
C3	7.56	7.42	7.53	7.46	7.33	7.45
C4	8.55	8.25	8.25	8.18	8.06	8.10
C5	9.52	9.14	9.06	9.10	8.89	8.95
C6	8.87	8.67	8.24	8.69	8.38	8.47
C7	8.49	8.27	8.14	8.16	8.03	8.02
C8	7.48	7.36	7.32	7.28	7.20	7.21
C9	6.48	6.49	6.48	6.41	6.43	6.40
C10	5.65	5.70	5.72	5.67	5.61	5.66
C11	4.75	4.98	4.91	4.94	4.86	4.80
C12	4.08	4.23	4.23	4.26	4.22	4.16
C13	3.38	3.58	3.56	3.49	3.66	3.53
C14	2.78	3.10	3.21	3.05	3.46	3.00
C15	2.40	2.61	2.68	2.61	3.31	2.75
alpha chain growth probability	0.78	0.79	0.79	0.79	0.81	0.79

C1 - C50 estimated total product distribution, weight %

C1	15.1	15.0	15.0	15.0	14.2	15.5
C2 - C4	17.4	16.8	17.1	17.2	15.4	16.8
C5 - C12	49.7	48.6	47.8	48.3	45.6	47.2
C13 - C50	17.8	19.6	20.1	19.6	24.8	20.5

CO conversion, %	6.0	5.4	5.2	5.2	4.7	4.5
rate, g CH ₂ /g cat/hr	0.27	0.25	0.23	0.23	0.21	0.21
CO ₂ formation, %	0.4	0.4	0.3	0.3	0.2	0.2

Performance of Co.028

Dates: 04/18/94 - - 04/19/94 Run #3 (re-calcine in flow air)

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 10.3 l/hr, H₂/CO ratio in feed = 2

time on stream, hr	30.0
reaction temperature, °C	220
pressure, atm	1
flow, cc/min	90.0

C1 - C15 product distribution, weight %

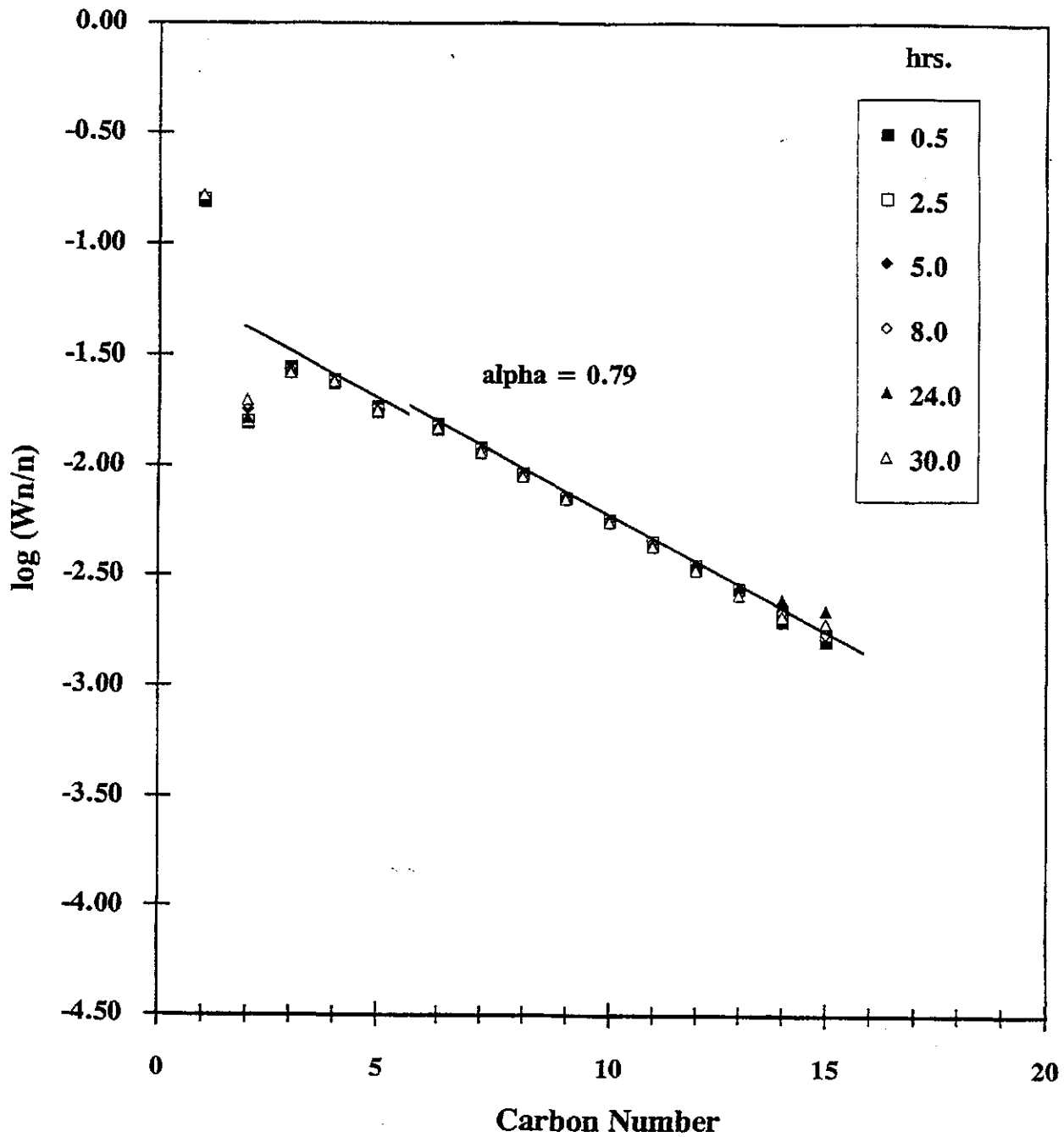
C1	17.43
C2	4.00
C3	7.50
C4	8.31
C5	9.02
C6	8.61
C7	8.06
C8	7.18
C9	6.38
C10	5.56
C11	4.73
C12	4.03
C13	3.36
C14	2.92
C15	2.91
alpha chain growth probability	0.80

C1 - C50 estimated total product distribution, weight %

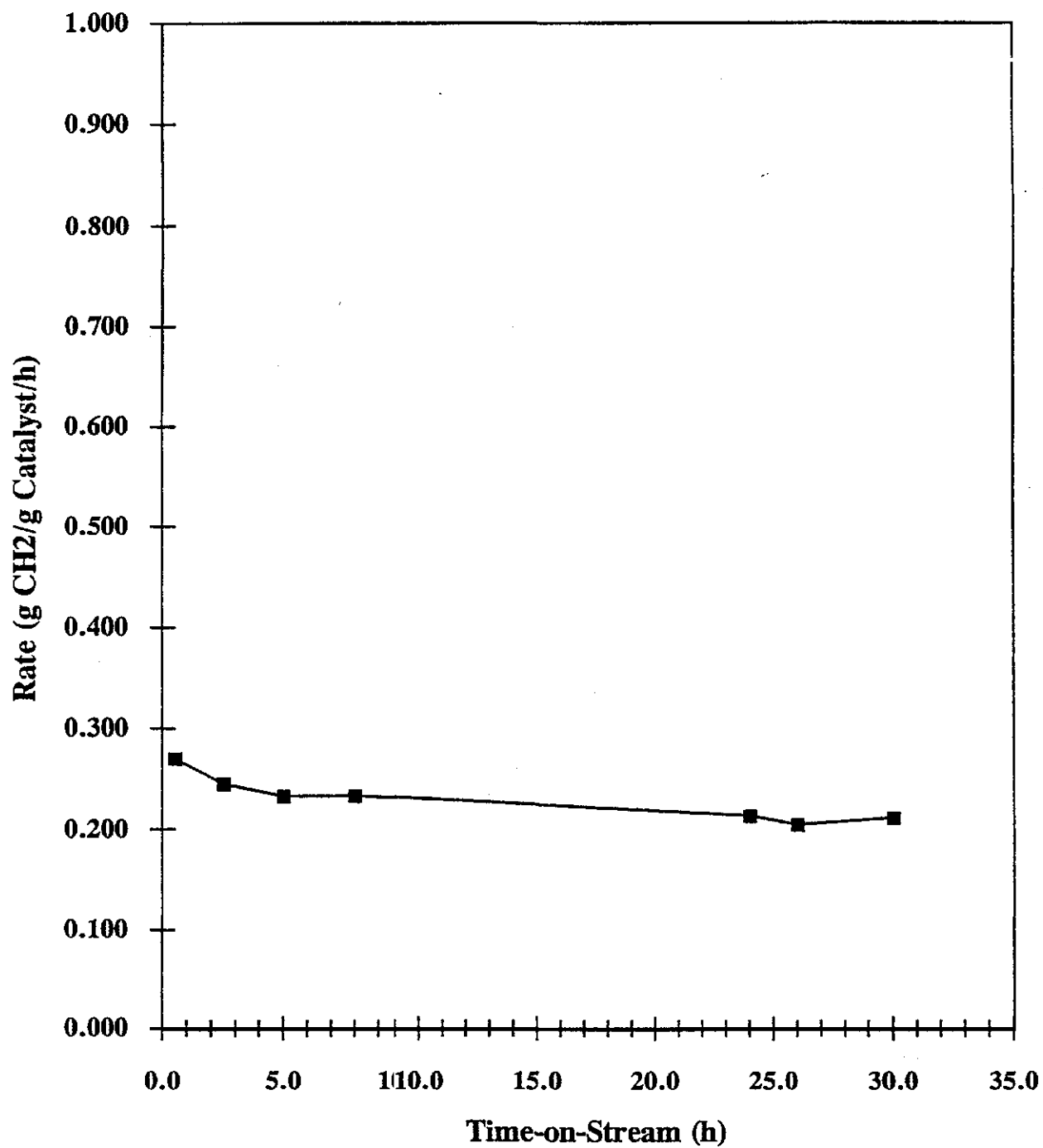
C1	14.9
C2 - C4	16.9
C5 - C12	46.7
C13 - C50	21.5

CO conversion, %	4.7
rate, g CH ₂ /g cat/hr	0.21
CO ₂ formation, %	0.2

Schulz-Flory Plot for Co.028 - Run #3
Time on Stream (hrs)



Time-on-Stream Plot for Co.028 - Run #3



(Co.029 - Run #1

Co wt%	NM wt %%	Promotor wt%		Support
30	Ru 0.500	K 0.50		Al ₂ O ₃

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.184 g
 WHSV = 133.99 1/hr
 time on stream = 26.0 hrs

CO₂ (g/g cat/hr) = 0.026
 CO₂ (% of CO) = 0.1
 O/P = 25.95

CO conversion (%)	2.8
rate (g CHH ₂ /g cat/hr)	0.17
alpha	0.79
C1 (wt% _b)	15.3
C2 - C4 ((wt%))	17.3
C5 - C12 ! (wt%)	48.0
C13 + (vwt%)	19.4

Performance of Co.029

Dates: 05/19/94 - 05/20/94 Run #1

flow rate = 90.0 cc/min, loading = 0.02 g, WHSV = 14.0 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	0.5	3.0	5.5	8.0	24.0	26.0
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	15.57	16.33	16.51	16.67	17.87	17.37
C2	3.49	3.66	3.70	3.86	3.92	3.83
C3	7.19	7.30	7.32	7.37	7.58	7.49
C4	8.31	8.18	8.15	8.21	8.40	8.30
C5	9.46	9.16	9.11	9.00	8.93	9.12
C6	9.02	8.64	8.40	8.51	7.87	8.46
C7	8.73	8.50	8.42	8.30	8.06	8.31
C8	7.66	7.53	7.52	7.40	7.27	7.39
C9	6.67	6.63	6.67	6.61	6.50	6.56
C10	5.81	5.79	5.86	5.88	5.67	5.60
C11	4.88	4.90	4.97	4.96	4.86	4.67
C12	4.19	4.30	4.22	4.18	4.18	3.94
C13	3.53	3.52	3.54	3.46	3.54	3.42
C14	3.03	3.03	3.05	2.99	2.91	2.95
C15	2.46	2.52	2.57	2.60	2.43	2.60
alpha chain growth probability	0.78	0.79	0.79	0.79	0.78	0.79

C1 - C50 estimated total product distribution, weight %

C1	14.0	14.6	14.7	14.8	16.1	15.3
C2 - C4	17.1	17.1	17.0	17.2	17.9	17.3
C5 - C12	50.5	49.3	49.0	48.5	47.7	48.0
C13 - C50	18.5	19.0	19.3	19.5	18.3	19.4

CO conversion, %	4.2	3.8	3.5	3.4	2.7	2.8
rate, g CH ₂ /g cat/hr	0.26	0.23	0.22	0.21	0.16	0.17
CO ₂ formation, %	0.3	0.2	0.1	0.2	0.3	0.1

Performance of Co.029

Dates: : 05/19/94 - 05/20/94 Run #1

flow rate = 90.0 cc/min, loading = 0.2 g, WHSV = 14.0 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	28.0
reaction temperature, °C	220
pressure, atm	1.0
flow, cc/min	90.0

C1 - C15 product distribution, weight %

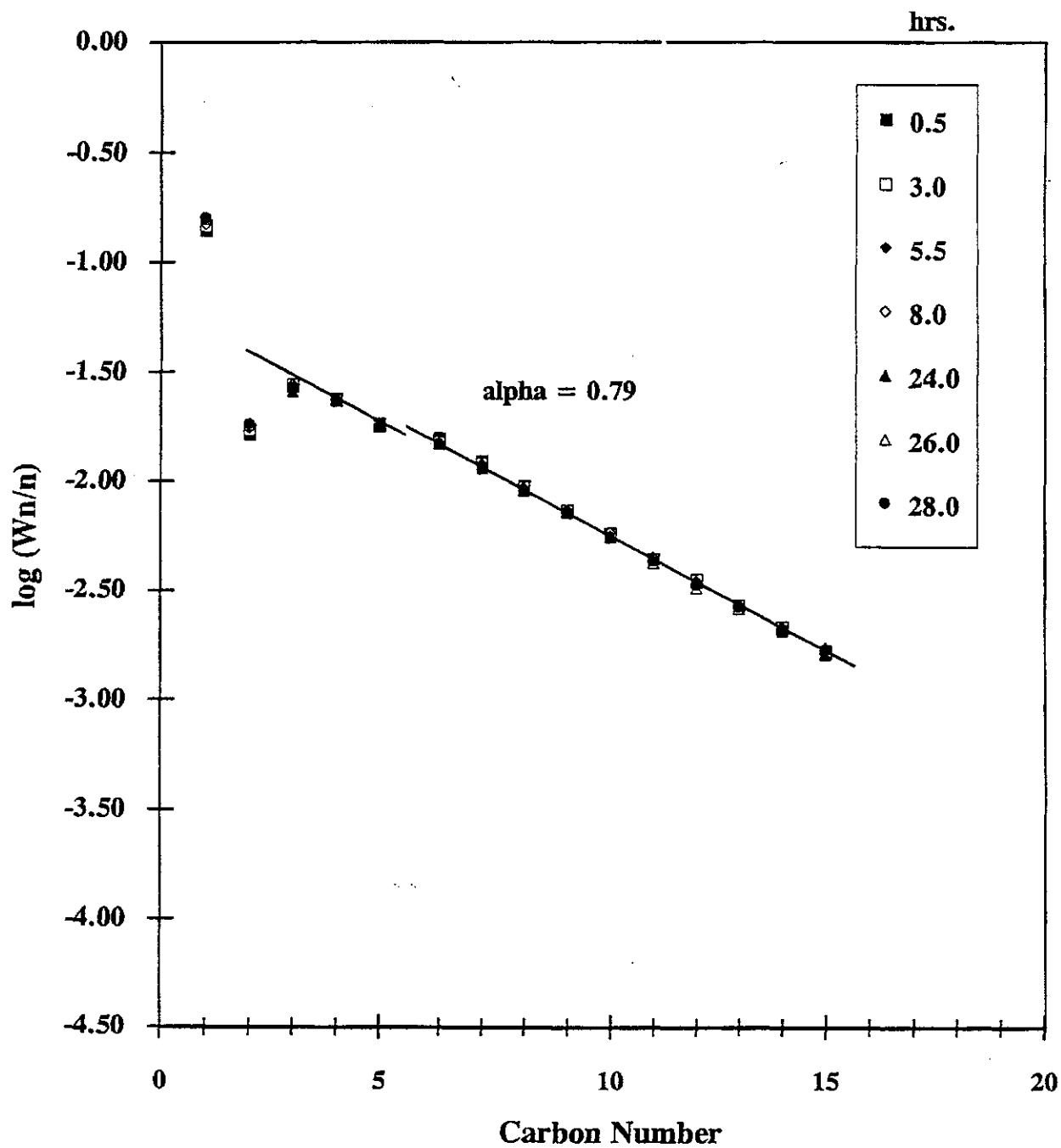
C1	17.61
C2	3.87
C3	7.53
C4	8.35
C5	9.03
C6	8.17
C7	8.19
C8	7.33
C9	6.53
C10	5.64
C11	4.77
C12	4.06
C13	3.48
C14	2.93
C15	2.52
alpha chain growth probability	0.79

C1 - C50 estimated total product distribution, weight %

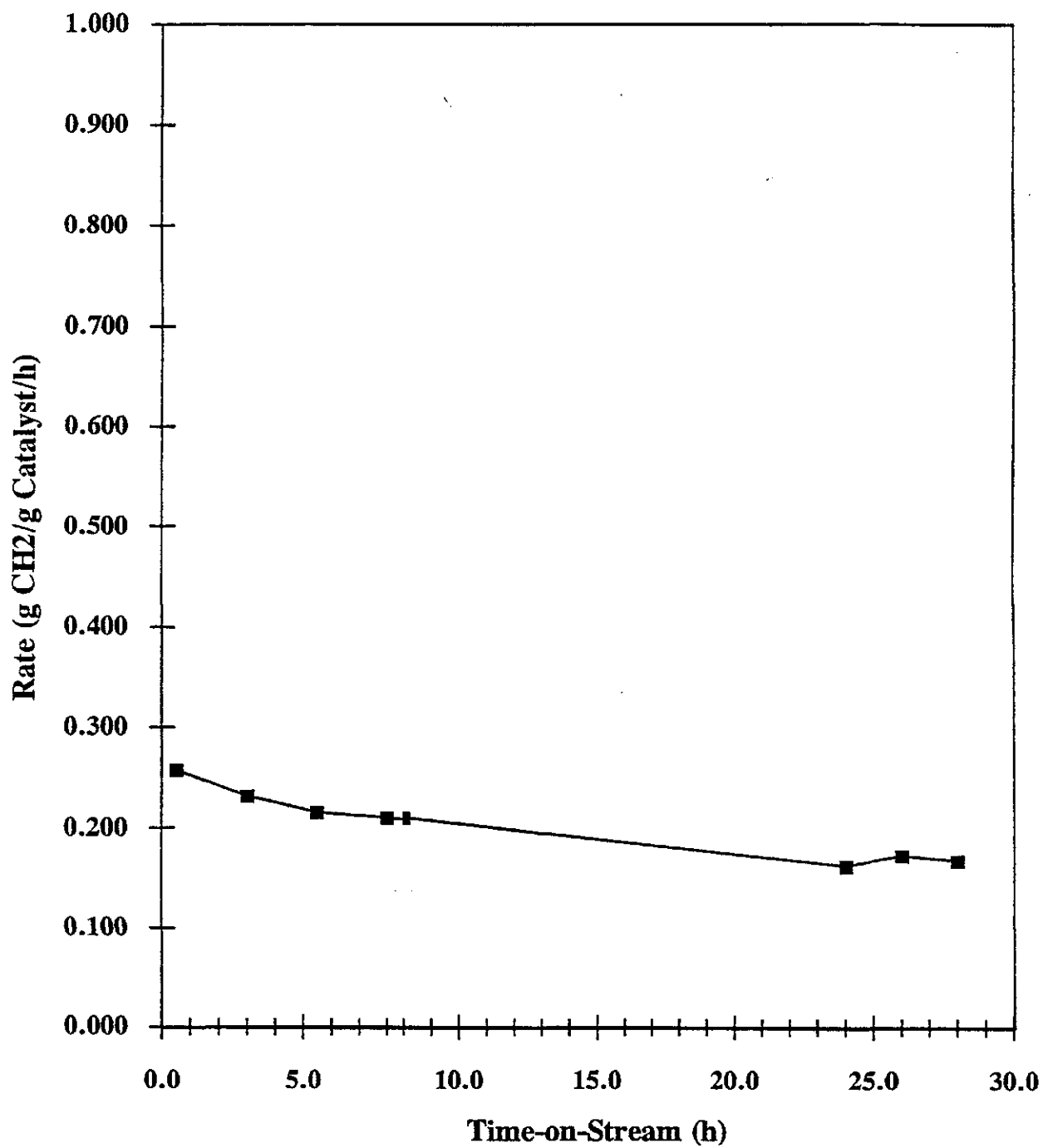
C1	15.7
C2 - C4	17.6
C5 - C12	47.9
C13 - C50	18.8

CO conversion, %	2.7
rate, g CH ₂ /g cat/hr	0.17
CO ₂ formation, %	0.2

Schulz-Flory Plot for Co.029 - Run #1
Time on Stream (hrs)



Time-on-Stream Plot for Co.029 - Run #1



(Co.039 - Run #2

Co wt%	NM wt %%	Promotor wt%		Support
12				TiO2

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.451 g
 WHSV = 2.885 1/hr
 time on stream = 21.5 hrs

CO₂ (g/g cat/hr) = 0.009
 CO₂ (% of CO) = 0.2
 O/P = 0.95

CO conversion (%)	3.9
rate (g CH ₄ /g cat/hr)	0.05
alpha	0.48
C1 (wt%)	42.4
C2 - C4 (wt%)	34.1
C5 - C12 (wt%)	23.4
C13 + (wt%)	0.2

Performance of Co.039

Dates: 06/01/94 - 06/02/94 Run #2

flow rate = 45.0 cc/min, loading = 0.0.5 g, WHSV = 2.9 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	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	45.0	45.0	45.0	45.0	45.0	45.0

C1 - C15 product distribution, weight %

C1	39.17	40.81	41.38	41.67	41.62	41.84
C2	6.29	6.41	6.42	6.42	6.40	6.40
C3	15.03	14.97	14.99	14.97	15.14	15.23
C4	12.99	12.73	12.63	12.52	12.58	12.60
C5	10.22	9.86	9.73	9.62	9.70	9.65
C6	6.39	6.00	5.90	5.87	5.85	5.96
C7	4.49	4.24	4.16	4.12	4.10	4.05
C8	2.62	2.35	2.38	2.28	2.28	2.19
C9	1.24	1.18	1.11	1.18	1.08	1.05
C10	0.73	0.66	0.62	0.63	0.60	0.60
C11	0.39	0.37	0.31	0.38	0.33	0.29
C12	0.28	0.25	0.24	0.22	0.22	0.13
C13	0.16	0.16	0.12	0.13	0.12	
C14						
C15						
alpha chain growth probability	0.51	0.50	0.49	0.51	0.50	0.49

C1 - C50 estimated total product distribution, weight %

C1	39.2	40.8	41.4	41.6	41.6	41.8
C2 - C4	34.3	34.1	34.0	33.9	34.1	34.2
C5 - C12	26.3	24.9	24.4	24.3	24.1	23.9
C13 - C50	0.3	0.2	0.2	0.3	0.2	0.2
CO conversion, %	4.7	4.5	4.3	4.2	4.1	4.0
rate, g CH ₂ /g cat/hr	0.06	0.06	0.05	0.05	0.05	0.05
CO ₂ formation, %	0.3	0.3	0.2	0.2	0.2	0.2

I Performance of Co.039

Dates: 06/01/94 - 06/02/94 Run #2

flow rate = 45.0 cc/min, loading = 0.5 g, WHSV = 2.9 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	18.5	21.5	24.5	27.5
reaction temperature, °C	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0
flow, cc/min	45.0	45.0	22.5	22.5

C1 - C15 product distribution, weight %

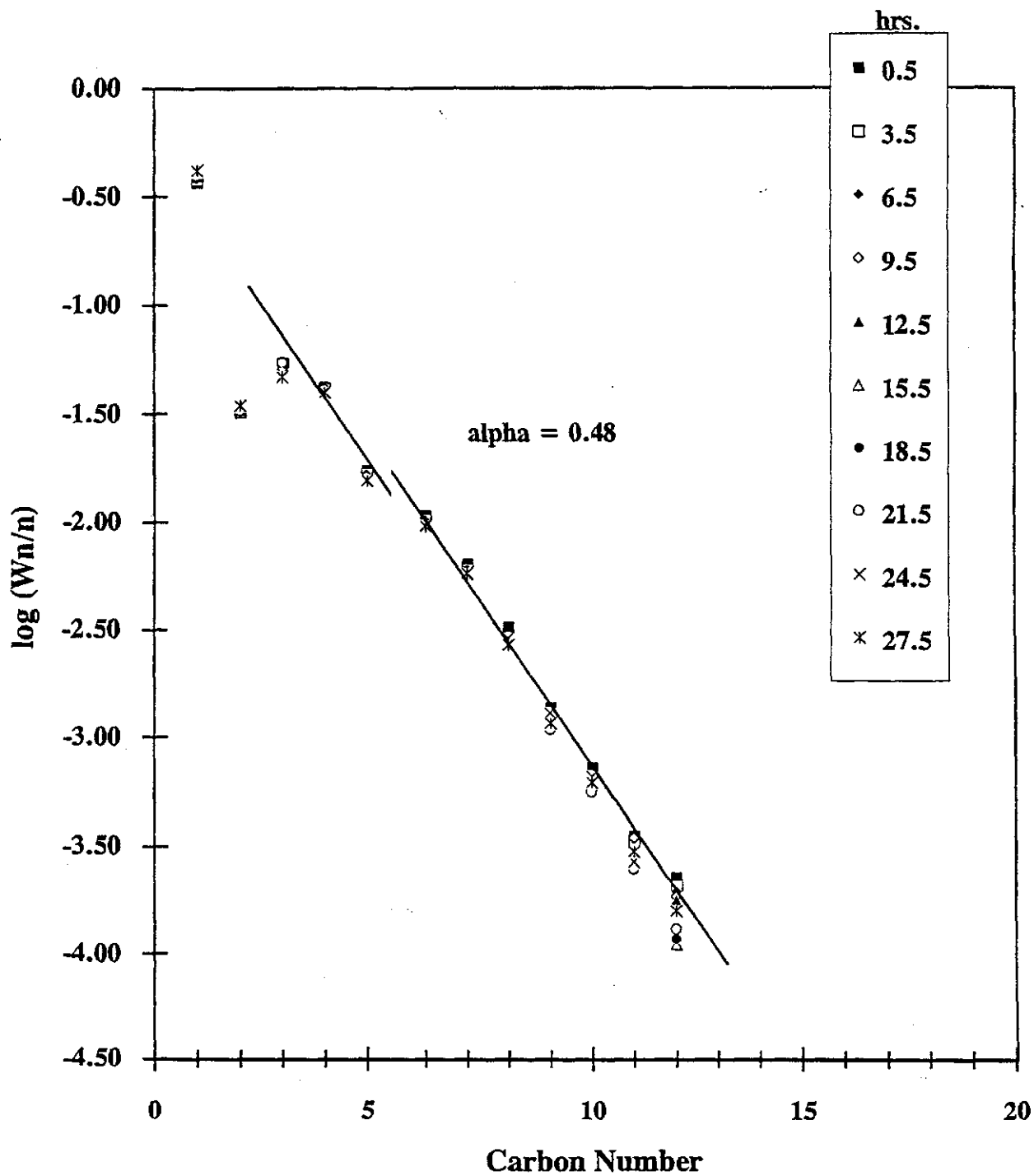
C1	42.24	42.44	43.30	44.13
C2	6.43	6.44	6.60	6.67
C3	15.19	15.23	13.59	13.48
C4	12.48	12.46	12.35	12.16
C5	9.51	9.49	9.56	9.29
C6	5.72	5.67	5.69	5.56
C7	4.16	4.08	4.00	4.05
C8	2.19	2.20	2.32	2.16
C9	1.08	0.98	1.17	1.05
C10	0.58	0.56	0.66	0.62
C11	0.29	0.28	0.30	0.33
C12	0.14	0.16	0.19	0.19
C13			0.14	0.15
C14			0.08	0.10
C15			0.05	0.06
alpha chain growth probability	0.49	0.48	0.49	0.50

C1 - C50 estimated total product distribution, weight %

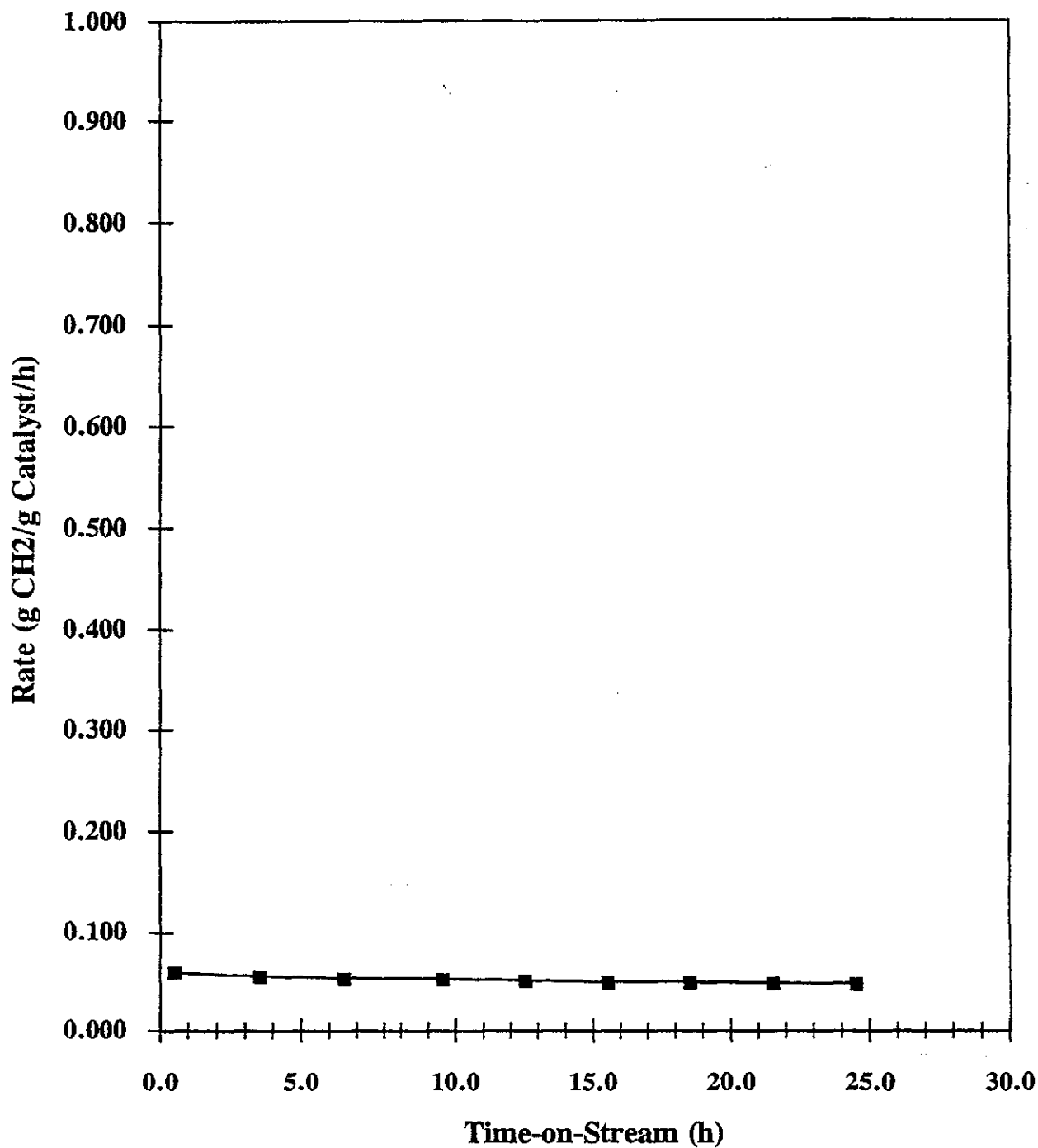
C1	42.2	42.4	43.4	44.2
C2 - C4	34.0	34.1	32.6	32.3
C5 - C12	23.6	23.4	23.9	23.3
C13 - C50	0.2	0.2	0.2	0.2

CO conversion, %	4.0	3.9	7.7	7.6
rate, g CH ₂ /g cat/hr	0.05	0.05	0.05	0.05
CO ₂ formation, %	0.2	0.2	0.6	0.6

Schulz-Flory Plot for Co.039 - Run #2
Time on Stream (hrs)



Time-on-Stream Plot for Co.039 - Run #2



(Co.040 - Run #2

Co wt%	NM wt %%	Promotor wt%		Support
12				TiO2

SUMMARY REACTION DATA

Reaction Conditions:

P = 1.0 atm
 T = 220 °C
 H₂/CO = 2
 weight of catalyst = 0.471 g
 WHSV = 2.773 1/hr
 time on stream = 21.5 hrs

CO₂ (g/g cat/hr) = 0.007
 CO₂ (% of CO) = 0.2
 O/P = 1.12

CO conversion (%)	2.8
rate (g CH ₂ /g cat/hr)	0.03
alpha	0.46
C1 (wt%)	44.6
C2 - C4 (wt%)	34.5
C5 - C12 (wt%)	20.8
C13 + (wt%)	0.1

Performance of Co.040

Dates: 06/29/94 - 06/30/94 Run #2

flow rate = 45.0 cc/min, loading = 0.0.5 g, WHSV = 2.7 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	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	45.0	45.0	45.0	45.0	45.0	45.0
C1 - C15 product distribution, weight %						
C1	39.82	41.94	42.60	42.99	43.79	43.91
C2	6.67	6.81	6.81	6.81	6.83	6.82
C3	15.67	15.67	15.69	15.72	15.75	15.75
C4	12.66	12.33	12.24	12.19	12.11	12.08
C5	9.91	9.41	9.31	9.17	9.10	9.08
C6	6.13	5.70	5.52	5.40	5.24	5.33
C7	4.52	4.10	3.99	3.95	3.81	3.83
C8	2.41	2.36	2.24	2.20	1.86	1.90
C9	1.12	0.98	0.96	0.91	0.90	0.82
C10	0.59	0.45	0.42	0.46	0.40	0.33
C11	0.30	0.25	0.23	0.22	0.20	0.15
C12	0.18					
C13						
C14						
C15						
alpha chain growth probability	0.50	0.48	0.47	0.48	0.47	0.45
C1 - C50 estimated total product distribution, weight %						
C1	39.7	41.8	42.5	42.9	43.7	43.8
C2 - C4	34.9	34.7	34.7	34.6	34.6	34.6
C5 - C12	25.1	23.3	22.7	22.4	21.6	21.5
C13 - C50	0.2	0.1	0.1	0.1	0.1	0.1
CO conversion, %	3.6	3.3	3.1	3.0	3.0	2.9
rate, g CH ₂ /g cat/hr	0.04	0.04	0.04	0.04	0.04	0.03
CO ₂ formation, %	0.2	0.2	0.2	0.2	0.2	0.2

Performance of Co.040

Dates: 06/29/94 - 06/30/94 Run #2

flow rate = 45.0 cc/min, loading = 0.0.5 g, WHSV = 2.7 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	220	220	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0	1.0	1.0
flow, cc/min	45.0	45.0	45.0	45.0	45.0	45.0

C1 - C15 product distribution, weight %

C1	39.82	41.94	42.60	42.99	43.79	43.91
C2	6.67	6.81	6.81	6.81	6.83	6.82
C3	15.67	15.67	15.69	15.72	15.75	15.75
C4	12.66	12.33	12.24	12.19	12.11	12.08
C5	9.91	9.41	9.31	9.17	9.10	9.08
C6	6.13	5.70	5.52	5.40	5.24	5.33
C7	4.52	4.10	3.99	3.95	3.81	3.83
C8	2.41	2.36	2.24	2.20	1.86	1.90
C9	1.12	0.98	0.96	0.91	0.90	0.82
C10	0.59	0.45	0.42	0.46	0.40	0.33
C11	0.30	0.25	0.23	0.22	0.20	0.15
C12	0.18					
C13						
C14						
C15						
alpha chain growth probability	0.50	0.48	0.47	0.48	0.47	0.45

C1 - C50 estimated total product distribution, weight %

C1	39.7	41.8	42.5	42.9	43.7	43.8
C2 - C4	34.9	34.7	34.7	34.6	34.6	34.6
C5 - C12	25.1	23.3	22.7	22.4	21.6	21.5
C13 - C50	0.2	0.1	0.1	0.1	0.1	0.1

CO conversion, %	3.6	3.3	3.1	3.0	3.0	2.9
rate, g CH ₂ /g cat/hr	0.04	0.04	0.04	0.04	0.04	0.03
CO ₂ formation, %	0.2	0.2	0.2	0.2	0.2	0.2

Performance of Co.040

Dates: 06/29/94 - 06/30/94 Run #2

flow rate = 45.0 cc/min, loading = 0.5 g, WHSV = 2.7 1/hr, H₂/CO ratio in feed = 2

time on stream, hr	18.5	21.5	24.5	27.5
reaction temperature, °C	220	220	220	220
pressure, atm	1.0	1.0	1.0	1.0
flow, cc/min	45.0	45.0	22.5	22.5

C1 - C15 product distribution, weight %

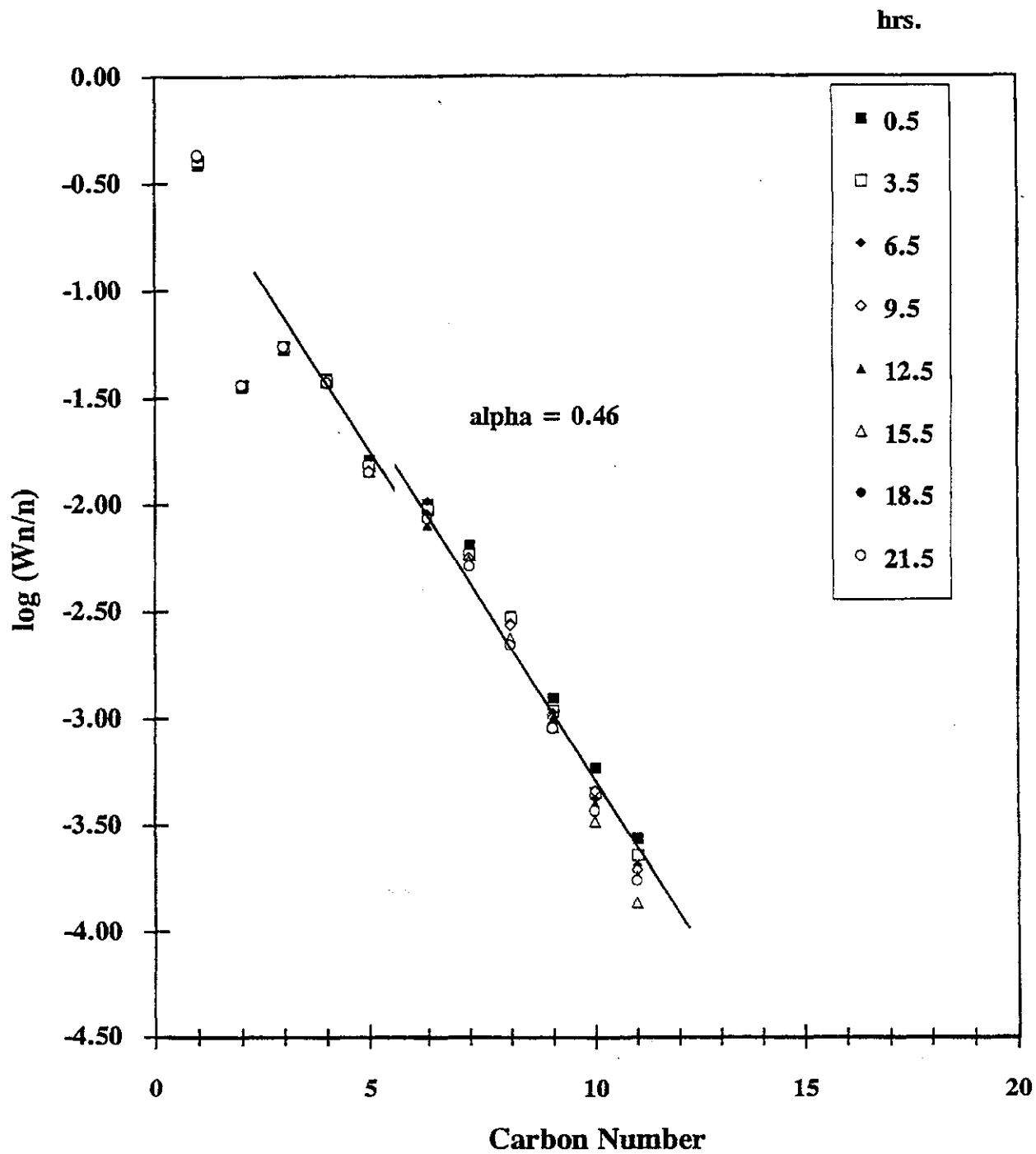
C1	44.52	44.64	45.52	46.01
C2	6.85	6.87	6.88	6.87
C3	15.73	15.77	14.19	14.19
C4	11.95	11.95	11.82	11.75
C5	8.90	8.82	8.89	8.79
C6	5.23	5.20	5.31	5.27
C7	3.66	3.62	3.77	3.64
C8	1.78	1.77	2.00	1.91
C9	0.84	0.81	0.94	0.89
C10	0.37	0.37	0.46	0.45
C11	0.19	0.19	0.23	0.22
C12				
C13				
C14				
C15				
alpha chain growth probability	0.46	0.46	0.48	0.48

C1 - C50 estimated total product distribution, weight %

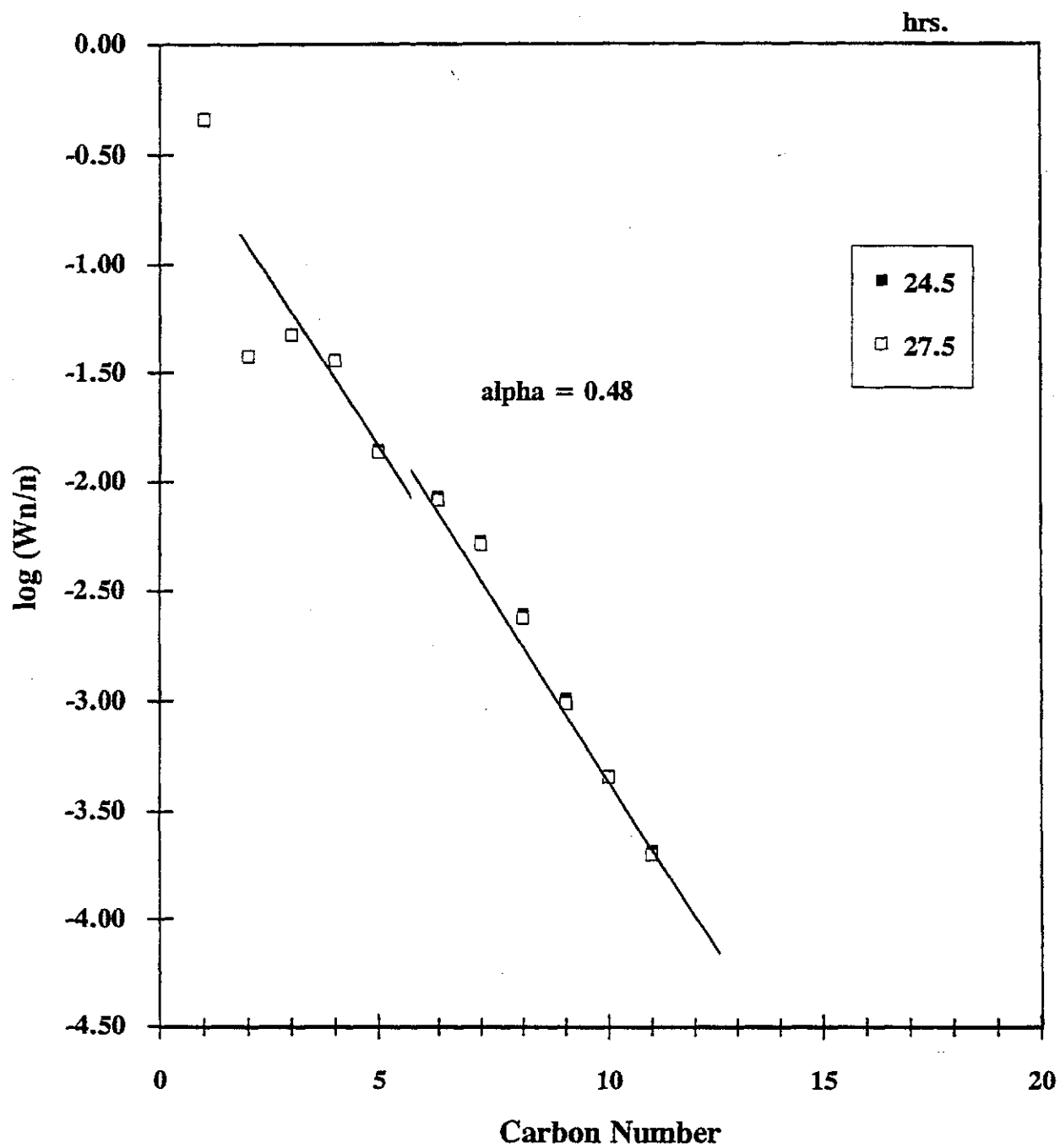
C1	44.4	44.6	45.4	45.9
C2 - C4	34.5	34.5	32.8	32.7
C5 - C12	21.0	20.8	21.7	21.3
C13 - C50	0.1	0.1	0.1	0.1

CO conversion, %	2.9	2.8	5.6	5.6
rate, g CH ₂ /g cat/hr	0.03	0.03	0.03	0.03
CO ₂ formation, %	0.2	0.2	0.4	0.4

Schulz-Flory Plot for Co.040 - Run #2
Time on Stream (hrs)



Schulz-Flory Plot for Co.040 - Run #2
High Conversion Study



Time-on-Stream Plot for Co.040 - Run #2

