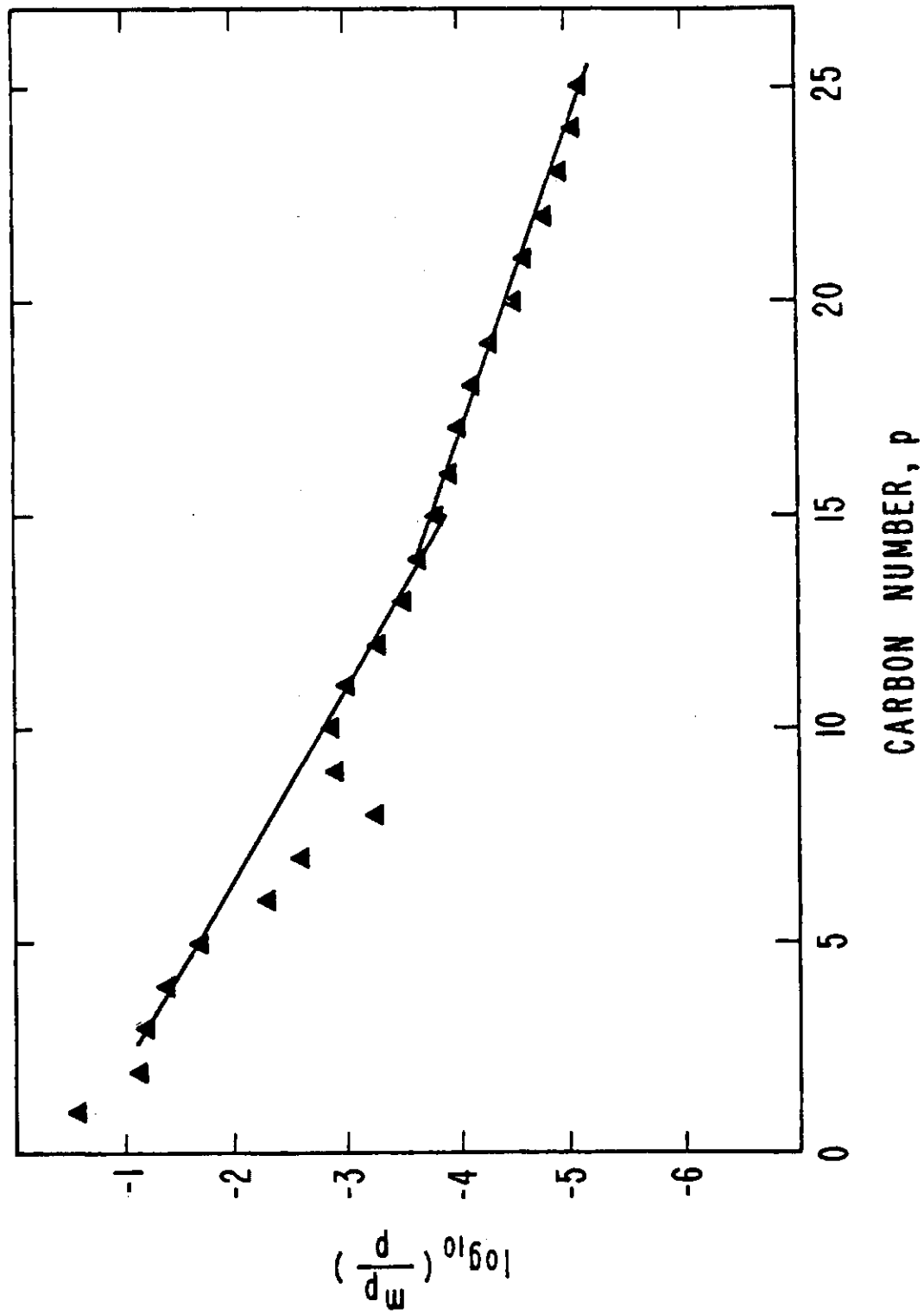
$\log_{10}\left(\frac{m_p}{p}\right)$
-1
-2
-3
-4
-5
-6
0
5
10
15
20
25
CARBON NUMBER, p

Figure 29

Schulz-Flory Distribution Law

Log (m_p/p) versus p;

Diluted Bed Reactor

Manganese/Iron Atomic Ratio = 2.4/100

Temperature = 533 K; Pressure = 3450 KPa;

H_2/CO = 2/1; Space Velocity = 1.08 $cm^3g^{-1}s^{-1}$.

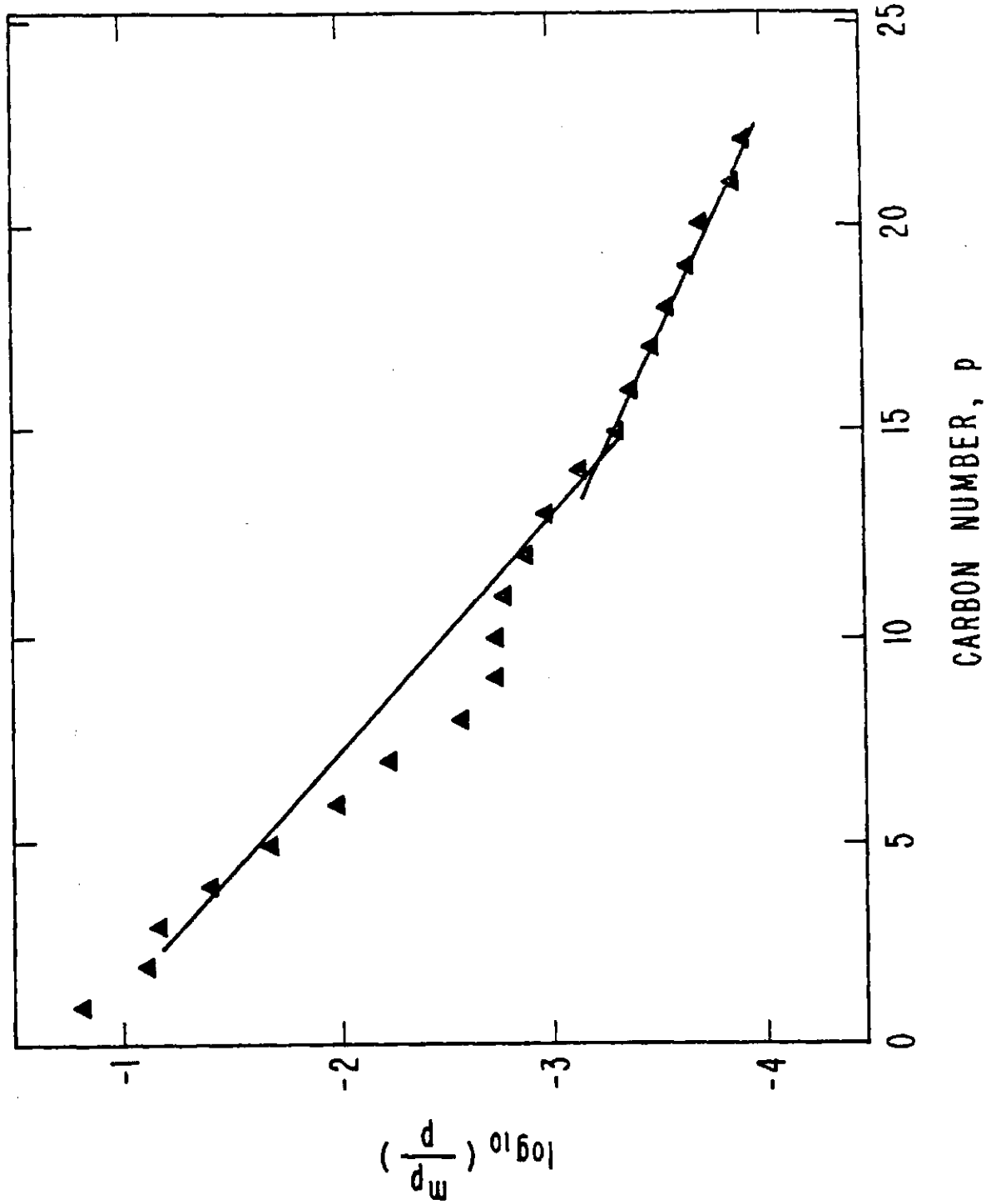
-1
-2
-3
-4
0
5
10
15
20
25
CARBON NUMBER, p
$\log_{10}\left(\frac{m_p}{d_m}\right)$

Table 7

Chain Growth Probability Factor Calculated from Slope and Intercept.

Reaction Temperature = 518 K

Points Used in Computation of α	α (Slope)	α (Intercept)
3-5, 10-15	0.598	0.594
16-25	0.722	0.860

Table 8

Chain Growth Probability Factor Calculated from Slope and Intercept.

Reaction Temperature = 533 K

Points Used in Computation of α	α (Slope)	α (Intercept)
3-5, 11-15	0.669	0.652
16-22	0.814	0.899

518 K was determined to be 0.598 from the slope and 0.594 from the intercept and at 533 K it was 0.669 from the slope and 0.652 from the intercept. In each of these calculations the data points for carbon numbers 6 through 9 (518 K) and 6 through 10 (533K) were dropped.

4.5 Process Variables Studies in the Diluted Bed Reactor

Although the determination of the effects of process variables on the hydrogenation of carbon monoxide in the diluted bed reactor was not the primary objective of this investigation a series of experiments were conducted to establish a bench mark for comparison with the process variable study in the diluted bed, pseudo slurry reactor. In addition, the diluted bed reactor exhibited a uniform temperature profile under our reaction conditions and it was thought that a process variable study would provide an excellent comparison to the previous work reported by Tsai[7,8] in a dense bed reactor. The effect of reaction temperature, reactor pressure, reactant hydrogen to carbon monoxide ratio, and space velocity on the hydrogenation of carbon monoxide were studied. The activity (as reflected by carbon monoxide conversion), the product distribution (as reflected by the methane, C_2-C_4 hydrocarbon, C_5^+ hydrocarbon, alcohol, and carbon dioxide yields) and the selectivity (as reflected by the olefin to paraffin ratio of the C_2 to C_4 hydrocarbons) were determined as a single operating parameter was varied. The process variable data obtained in this investigation are presented in Table 4 and Figure 30 through Figure 42. The yields of methane, C_2-C_4 hydrocarbons, and carbon dioxide as a function of reaction temperature are plotted in Figure 30. As the reaction temperature

Figure 30

Effect of Temperature on Yield and Selectivity

Diluted Bed Reactor

Pressure = 2760 KPa; H_2/CO = 2/1;

Space Velocity = 1 $cm^3 g^{-1} s^{-1}$.

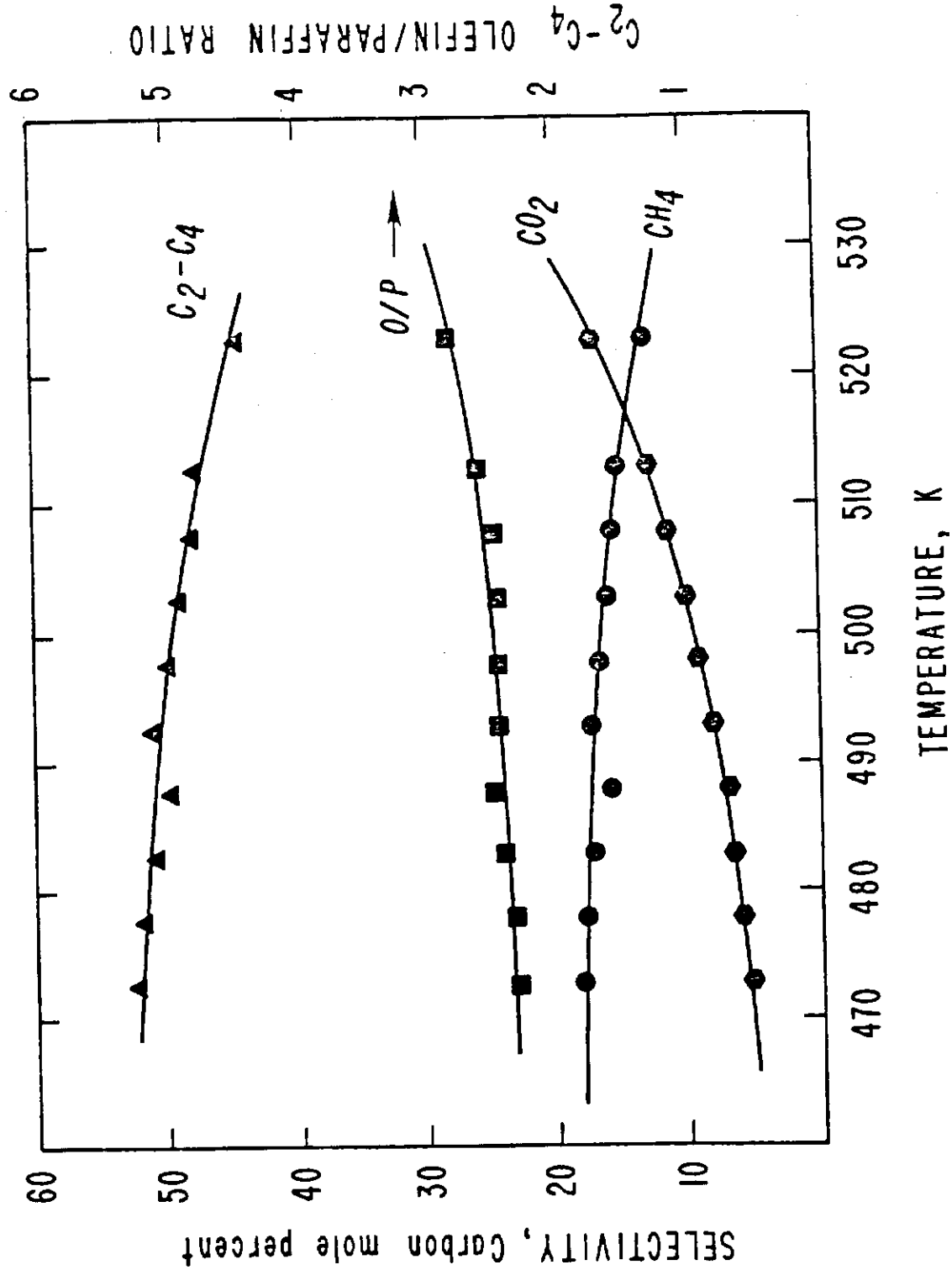
C_2-C_4 OLEFIN/PARAFFIN RATIO
6
5
4
3
2
1
C_2-C_4
O/P
CO_2
CH_4
60
50
40
30
20
10
SELECTIVITY, Carbon mole percent
470
480
490
500
510
520
530
TEMPERATURE, K

Figure 31

Effect of Temperature on Olefin Selectivity

Olefin/Paraffin Ratio of C_2-C_4 Hydrocarbons

Diluted Bed Reactor

Pressure = 2760 KPa; H_2/CO = 2/1;

Space Velocity = 1 $cm^3 g^{-1} s^{-1}$.

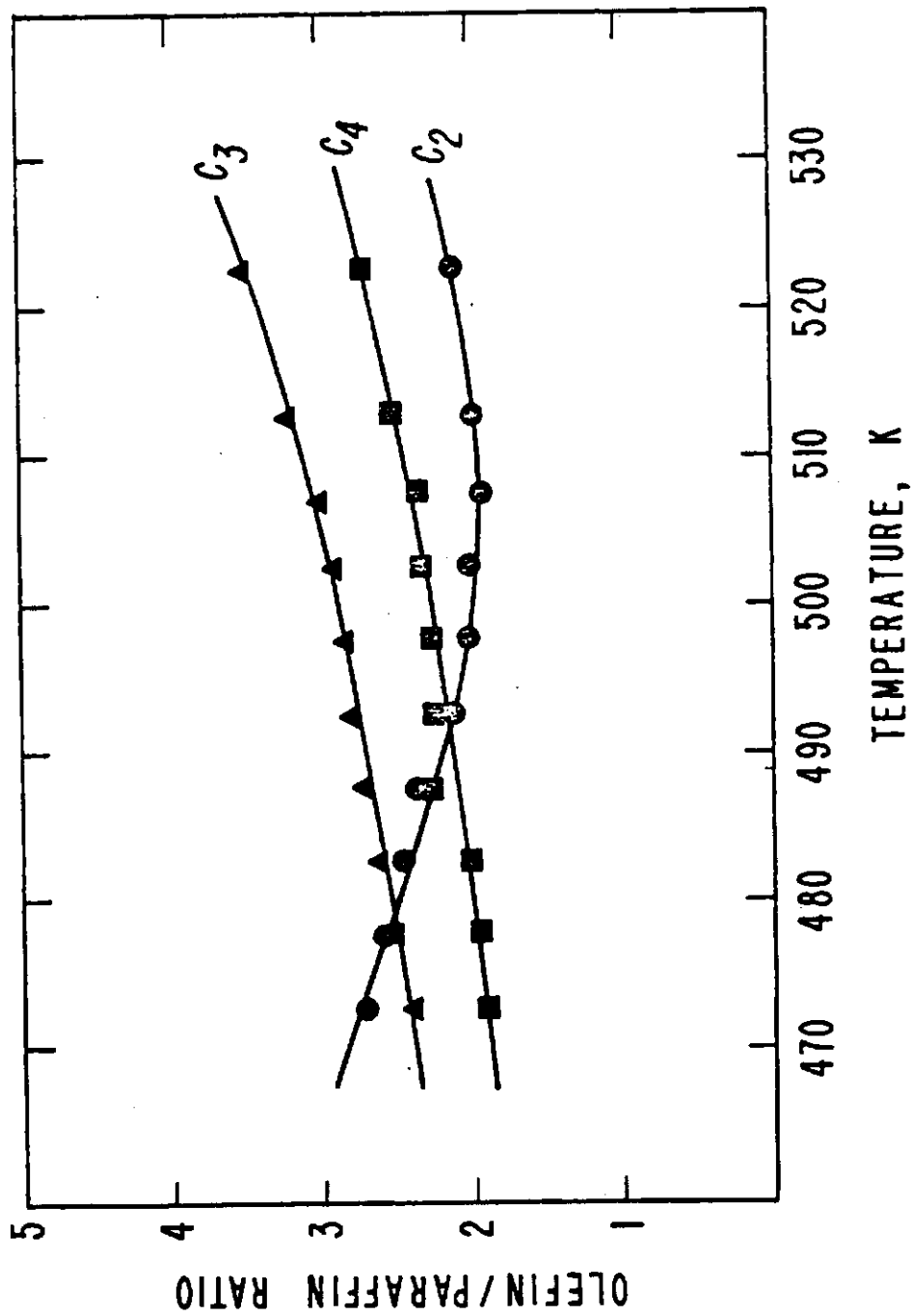
C3
C4
C2
OLEFIN / PARAFFIN RATIO
5
4
3
2
1
470
480
490
500
510
520
530
TEMPERATURE, K

Figure 32

Effect of Temperature on Yield and Selectivit

Diluted Bed Reactor

Pressure = 2070 KPa; H_2/CO = 2/1;

Space Velocity = 0.5 $cm^3g^{-1}s^{-1}$

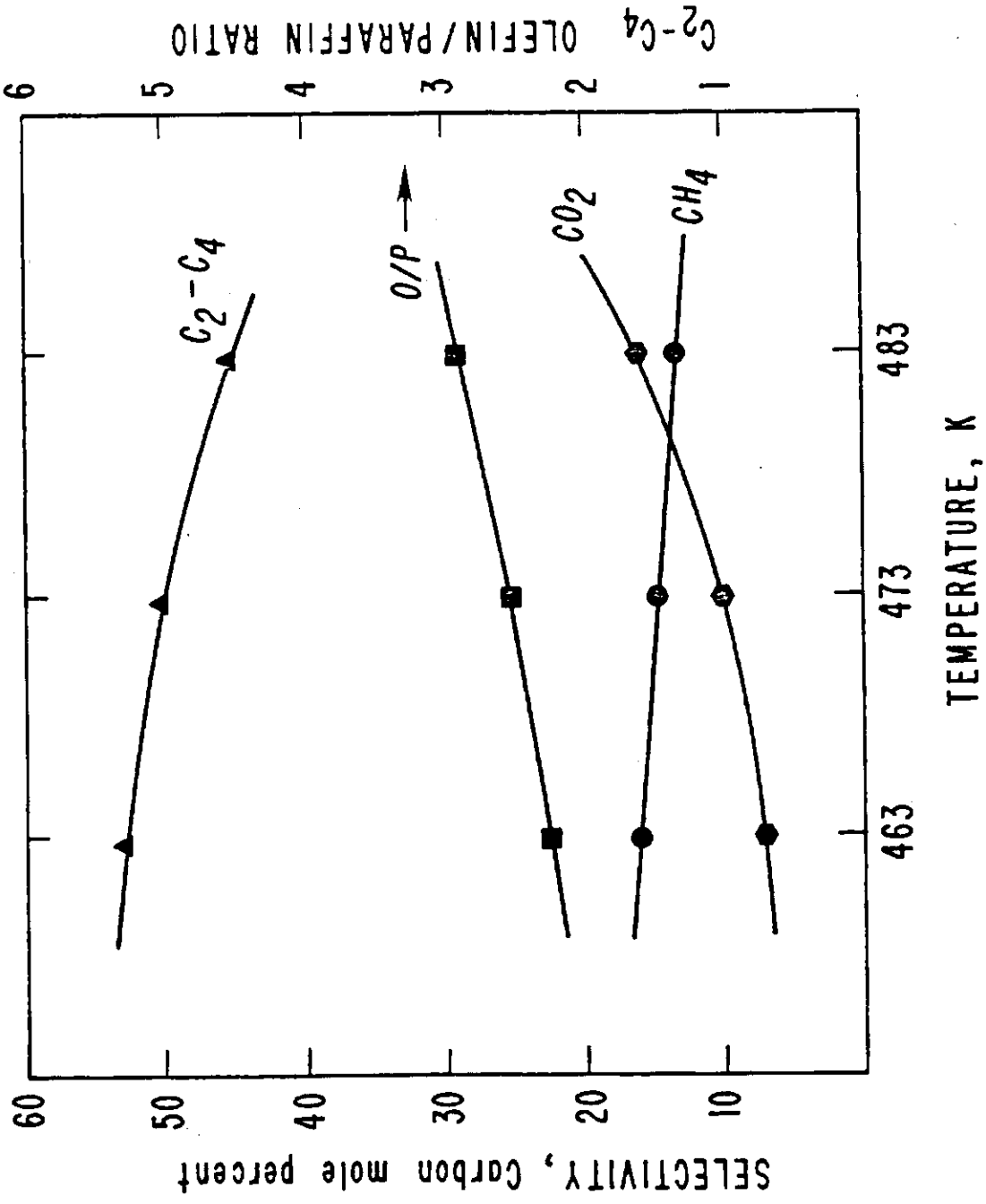
SELECTIVITY, Carbon mole percent
60
50
40
30
20
10
TEMPERATURE, K
463
473
483
C_2-C_4 OLEFIN/PARAFFIN RATIO
6
5
4
3
2
1
C_2-C_4
O/P
CO_2
CH_4

Figure 33

Effect of Temperature on Yield and Selectivity

Diluted Bed Reactor

Pressure = 2070 KPa; H_2/CO = 2/1;

Space Velocity = 1 $cm^3g^{-1}s^{-1}$.

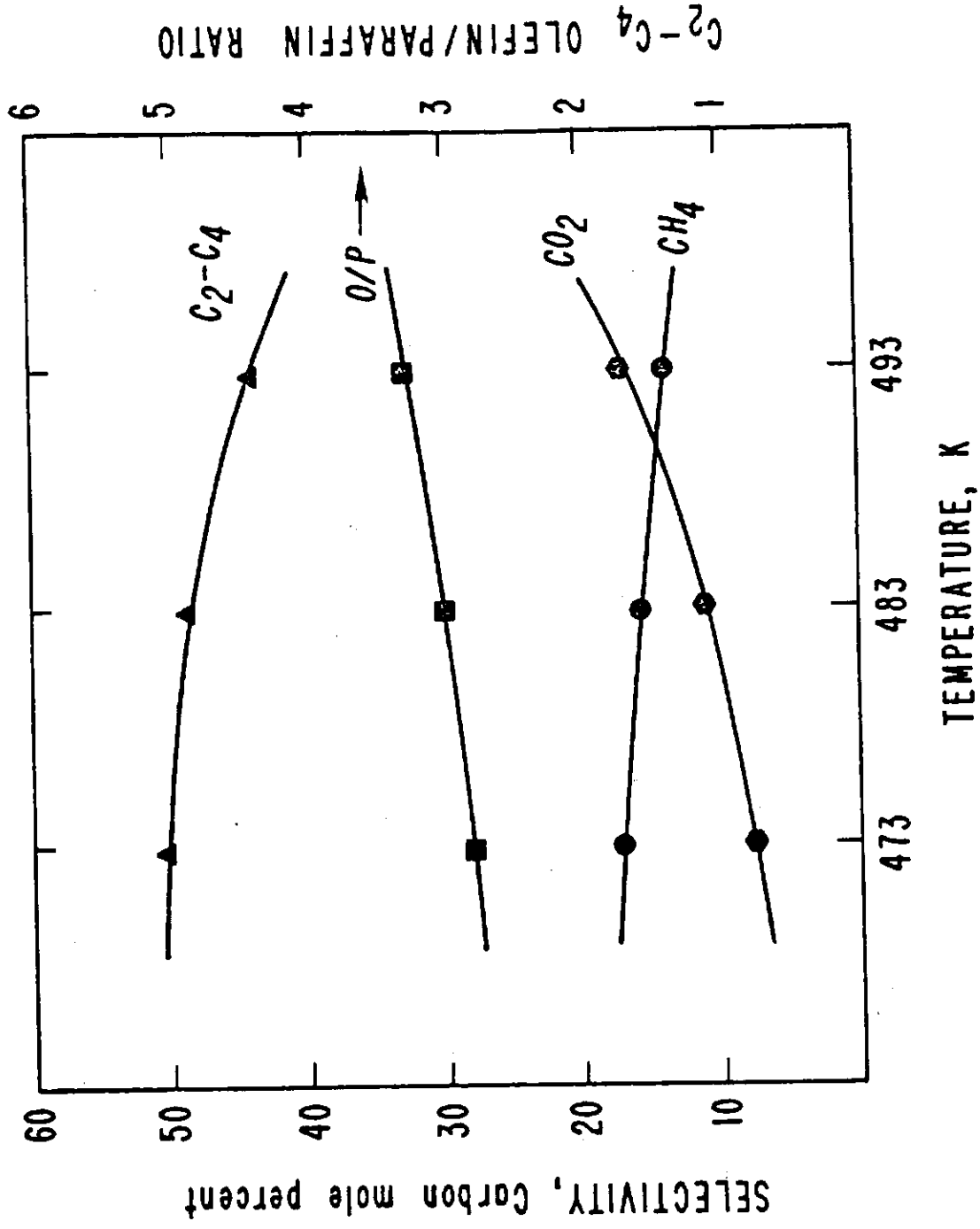
SELECTIVITY, Carbon mole percent
60
50
40
30
20
10
TEMPERATURE, K
473
483
493
C_2-C_4 OLEFIN/PARAFFIN RATIO
6
5
4
3
2
1
C_2-C_4
O/P
CO_2
CH_4

Figure 34

Effect of Temperature on Yield and Selectivity

Diluted Bed Reactor

Pressure = 2760 KPa; H_2/CO = 2/1;

Space Velocity = 0.5 $cm^3g^{-1}s^{-1}$.

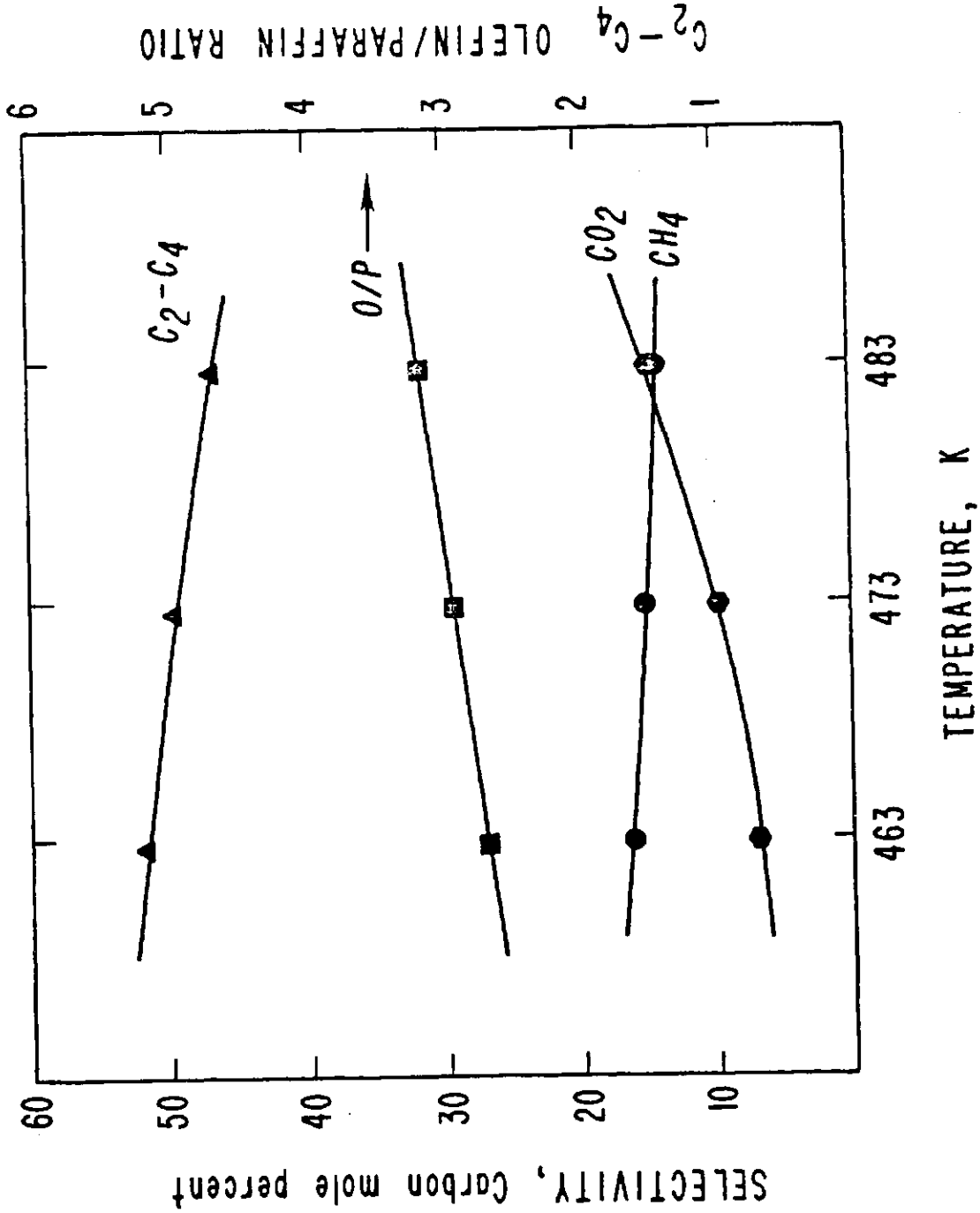
SELECTIVITY, Carbon mole percent
60
50
40
30
20
10
TEMPERATURE, K
463
473
483
C_2-C_4 OLEFIN/PARAFFIN RATIO
6
5
4
3
2
1
C_2-C_4
O/P
CO_2
CH_4

Figure 35

Effect of Pressure on Yield and Selectivity

Diluted Bed Reactor

Temperature = 83 K; H_2/CO = 2/1;

Space Velocity = 1 $cm^3 g^{-1} s^{-1}$.

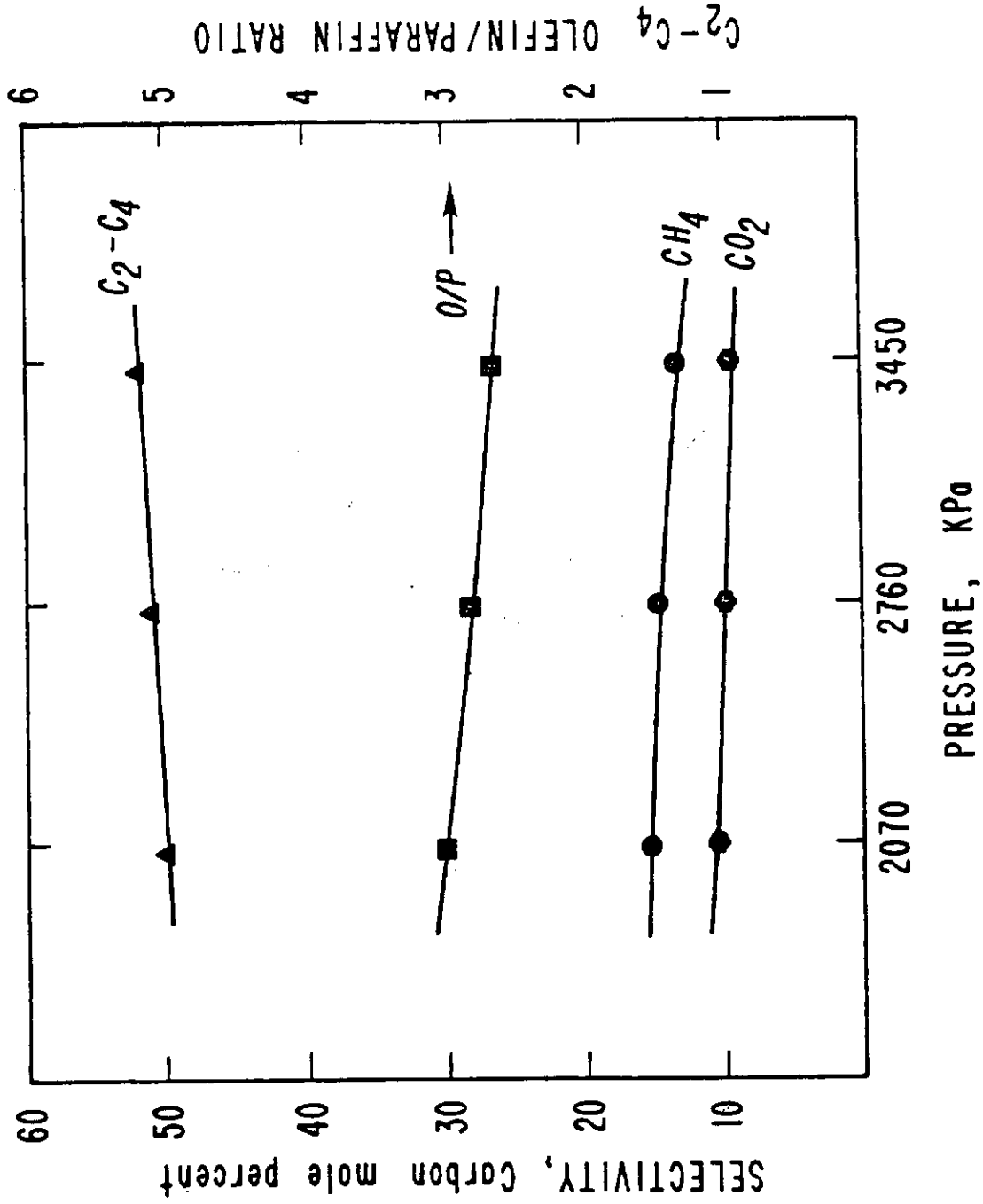
SELECTIVITY, Carbon mole percent
60
50
40
30
20
10
C_2-C_4 OLEFIN/PARAFFIN RATIO
6
5
4
3
2
1
C_2-C_4
O/P
CH_4
CO_2
2070
2760
3450
PRESSURE, KPa

Figure 36

Effect of Pressure on Yield and Selectivity

Diluted Bed Reactor

Temperature = 463 K; H_2/CO = 2/1;

Space Velocity = 0.5 $cm^3 g^{-1} s^{-1}$.

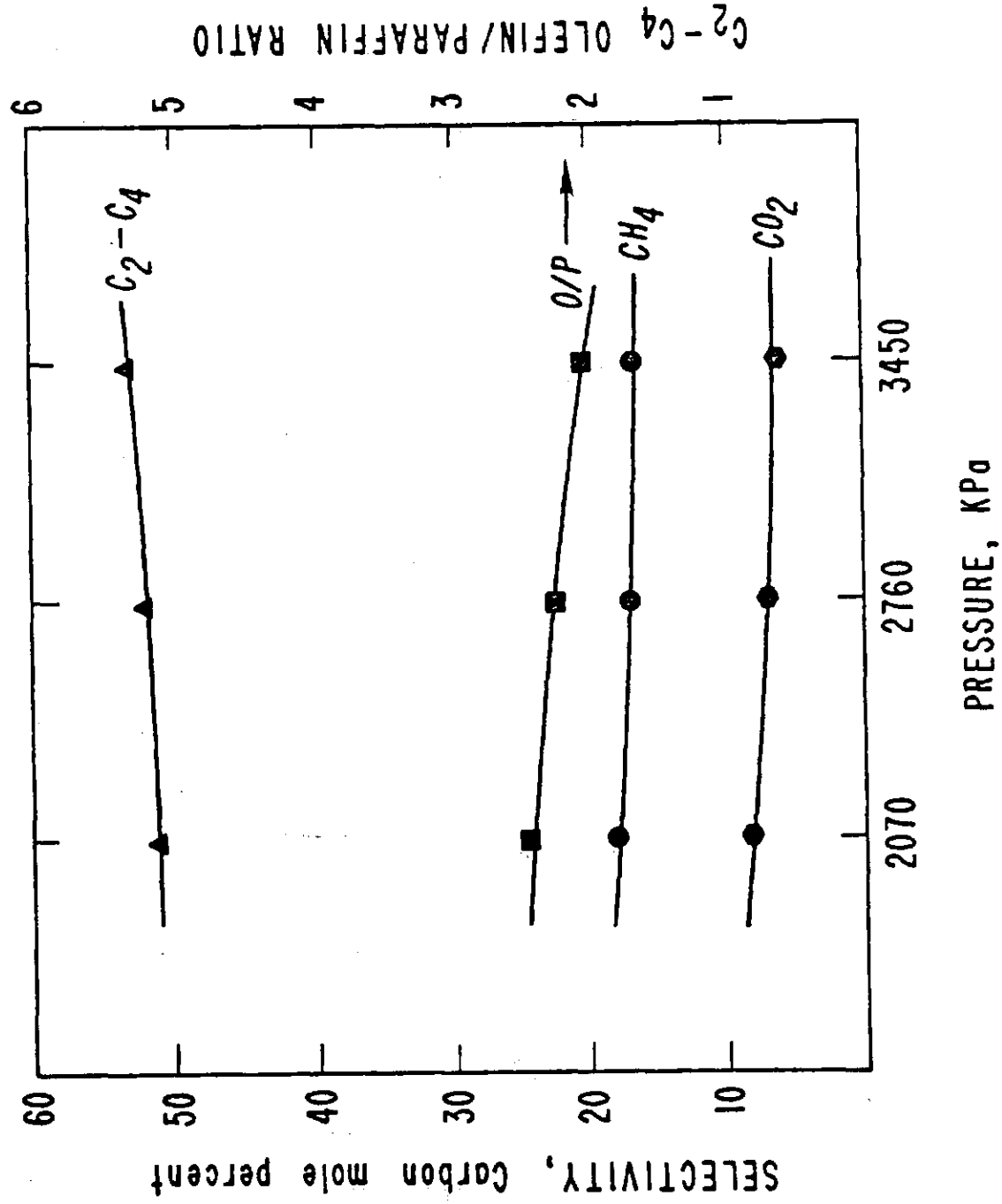
SELECTIVITY, Carbon mole percent
60
50
40
30
20
10
C_2-C_4 OLEFIN/PARAFFIN RATIO
6
5
4
3
2
1
C_2-C_4
O/P
CH_4
CO_2
2070
2760
3450
PRESSURE, KPa

Figure 37

Effect of Space Velocity on Yield and Selectivity

Diluted Bed Reactor

Temperature = 473 K; Pressure = 2070 KPa;

H_2/CO = 2/1.