increasing temperature at constant pressure and decreased with decreasing pressure (Figure 45). At reaction temperatures below 475 K, the low carbon monoxide conversions resulted in little product formation. Thus product analysis was difficult at best and the scatter in the data is to be expected. The data listed in Appendix H indicate that at fixed values of the total pressure, hydrogen-to-carbon monoxide ratio and space velocity, the methane yield decreased as the reaction temperature increased. The effect of temperature on the olefin-to-paraffin ratio of the C_2-C_4 hydrocarbons at different total pressures is presented in Figure 46 through Figure 50. The olefin-to-paraffin ratio of the total C_2-C_4 hydrocarbon fraction increased with increasing temperature at all total reactor pressures studied, that is, increasing from a ratio of approximately 2/1 to a ratio of 3/1. The olefin-to-paraffin ratio of the C_3 and C_4 hydrocarbon fractions increased with increasing reaction temperature at all reactor pressures studied. In all experiments the olefin-to-paraffin ratio of the C_3 hydrocarbon fraction was greater than the olefin-to-paraffin ratio of the C_4 hydrocarbon fraction. The ethylene-to-ethane ratio did not exhibit a consistent trend as the reaction temperature increased nor as the pressure changed, that is, in some instances the ratio increased with increasing temperature (pressure = 4400 KPa, Figure 50) whereas in other cases the ratio decreased with increasing temperature (pressure = 2000 KPa, Figure 47). The olefin-to-paraffin ratio of the C_2 hydrocarbon fraction was consistently less than the olefin-to-paraffin ratio of the C_3 hydrocarbon fraction with the exception of the experiment conducted at 4400 KPa.

Figure 46

Effect of Temperature on Olefin Selectivity

Diluted Bed, Pseudo Slurry Reactor

Pressure = 1400 KPa; H_2/CO = 2/1;

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

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.

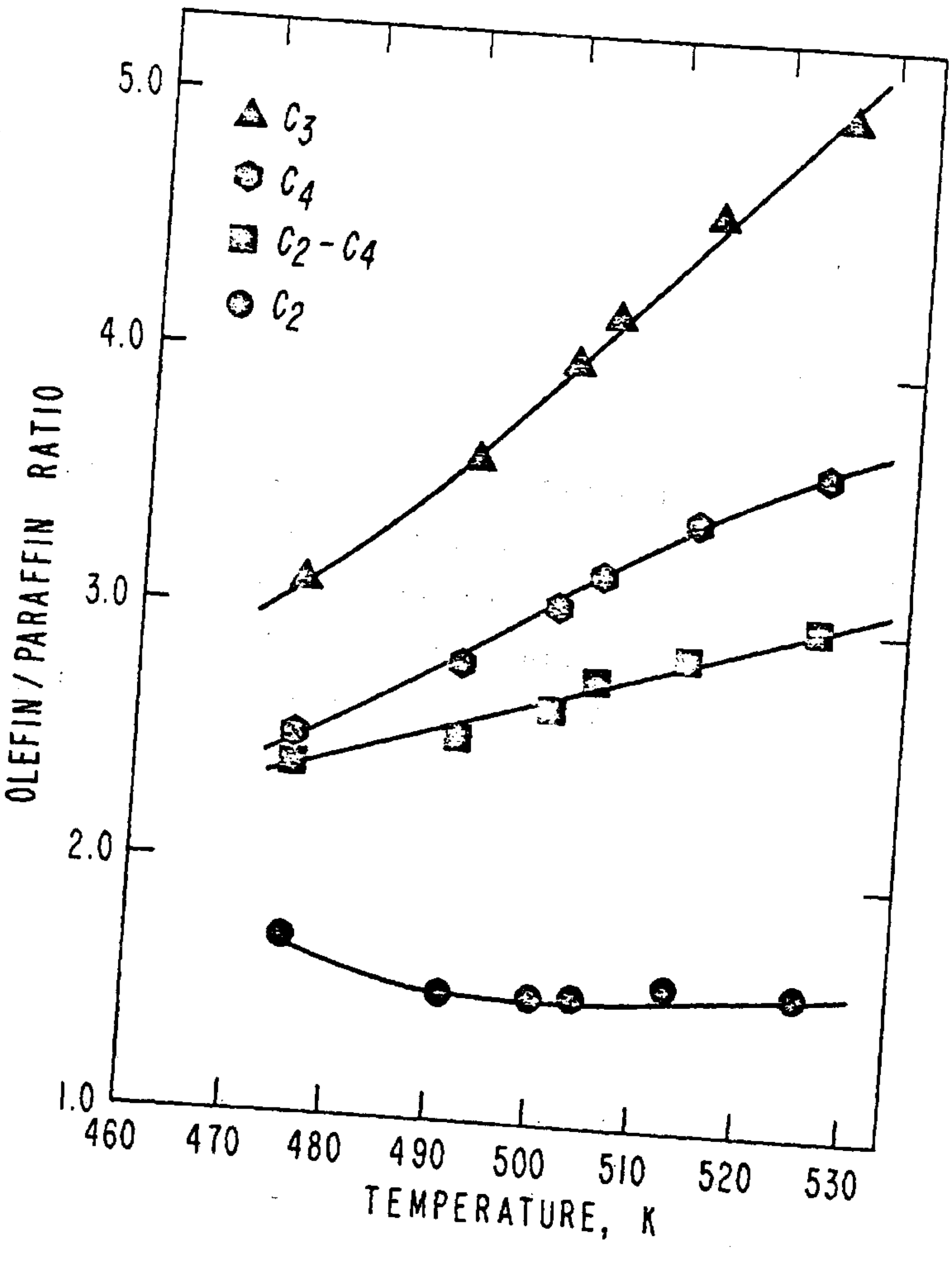

OLEFIN / PARAFFIN RATIO
5.0
4.0
3.0
2.0
1.0
C3
C4
C2-C4
C2
460
470
480
490
500
510
520
530
TEMPERATURE, K

Figure 47

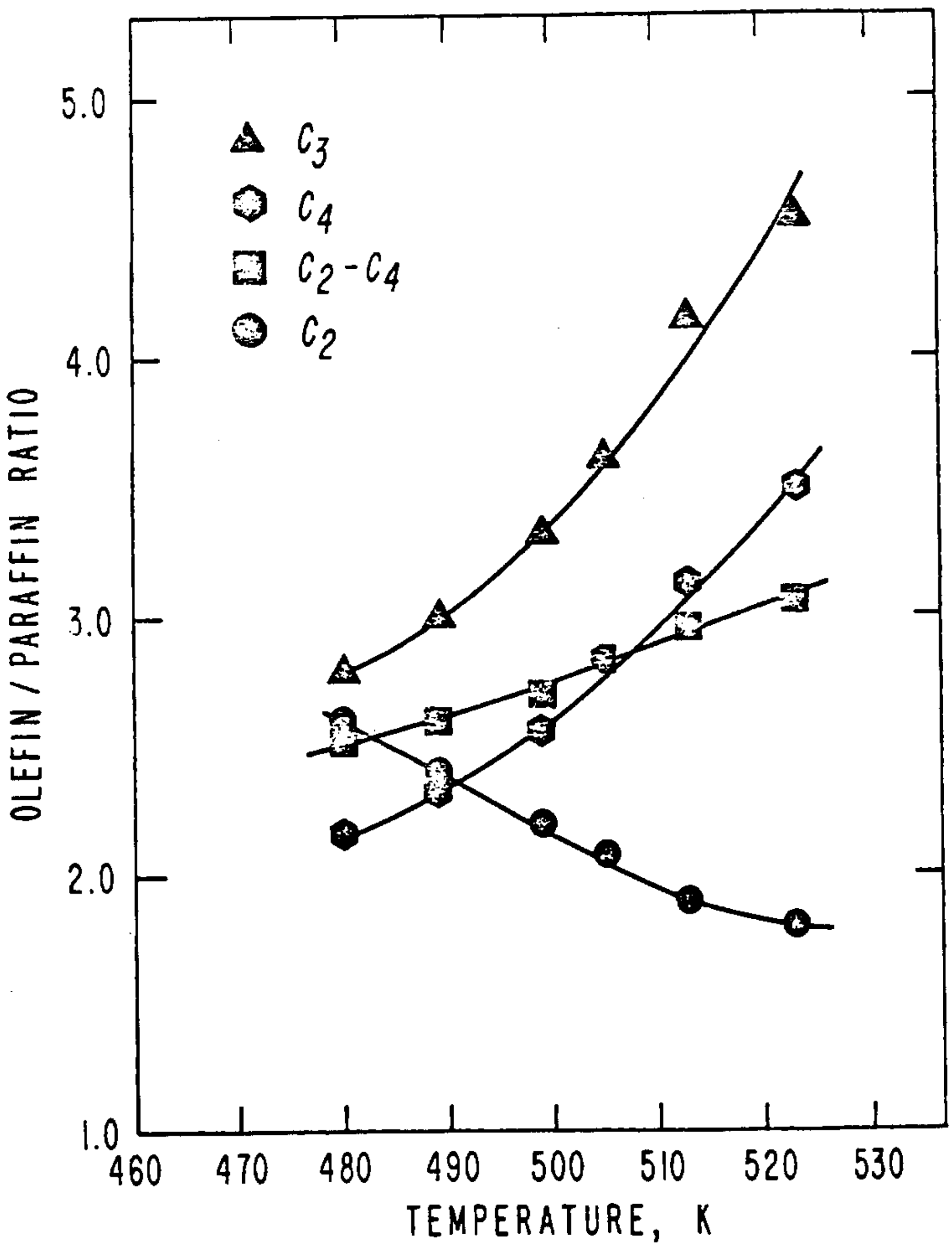
Effect of Temperature on Olefin Selectivity

Diluted Bed, Pseudo Slurry Reactor

Pressure = 2000 KPa; $H_2/CO = 2/1$;

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

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.



5.0
4.0
3.0
2.0
1.0
OLEFIN / PARAFFIN RATIO
C3
C4
C2-C4
C2
460
470
480
490
500
510
520
530
TEMPERATURE, K

Figure 48

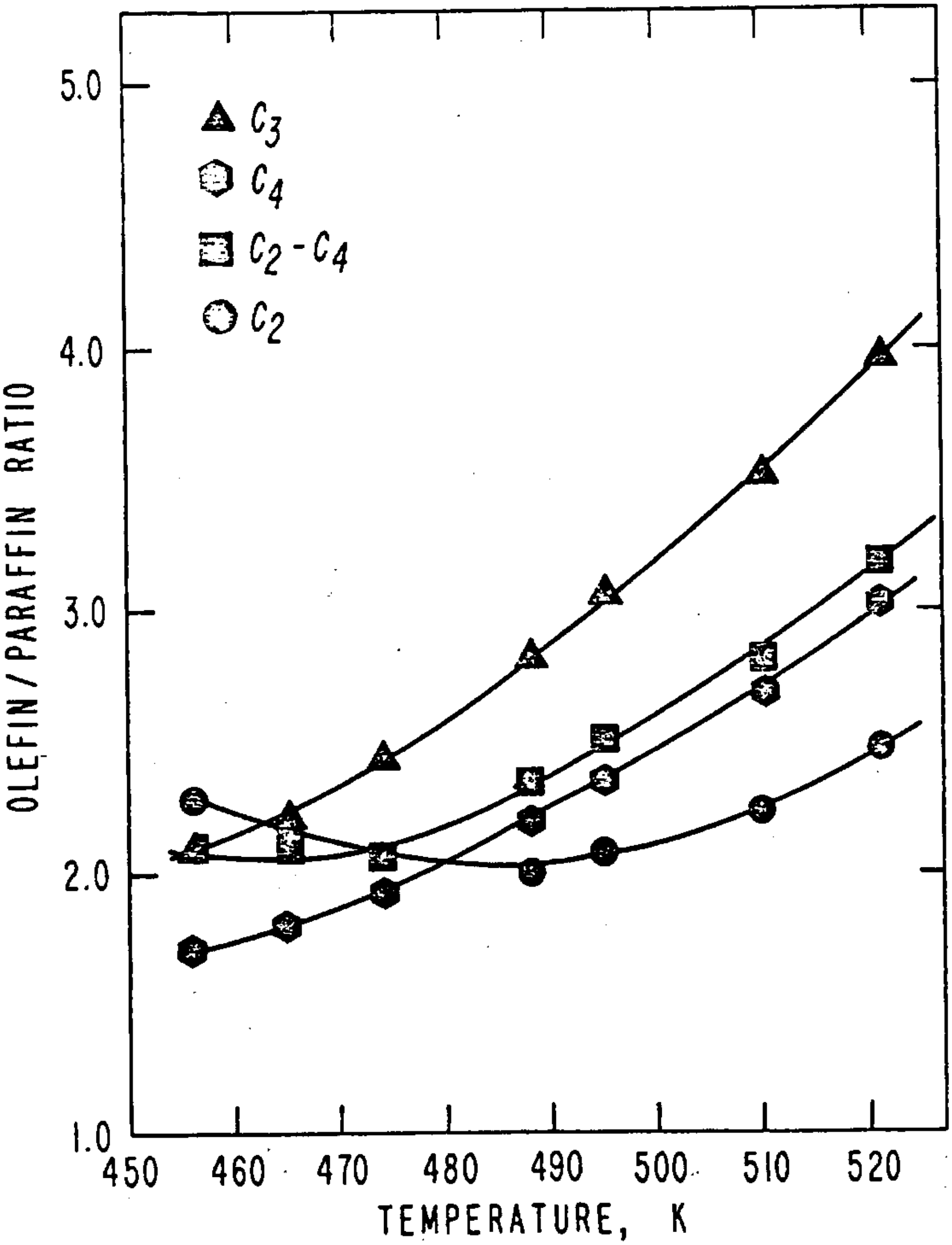
Effect of Temperature on Olefin Selectivity

Diluted Bed, Pseudo Slurry Reactor

Pressure = 2600 KPa; $H_2/CO = 2/1$;

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

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.



5.0
4.0
3.0
2.0
1.0
OLEFIN/PARAFFIN RATIO
C3
C4
C2-C4
C2
450
460
470
480
490
500
510
520
TEMPERATURE, K

Figure 49

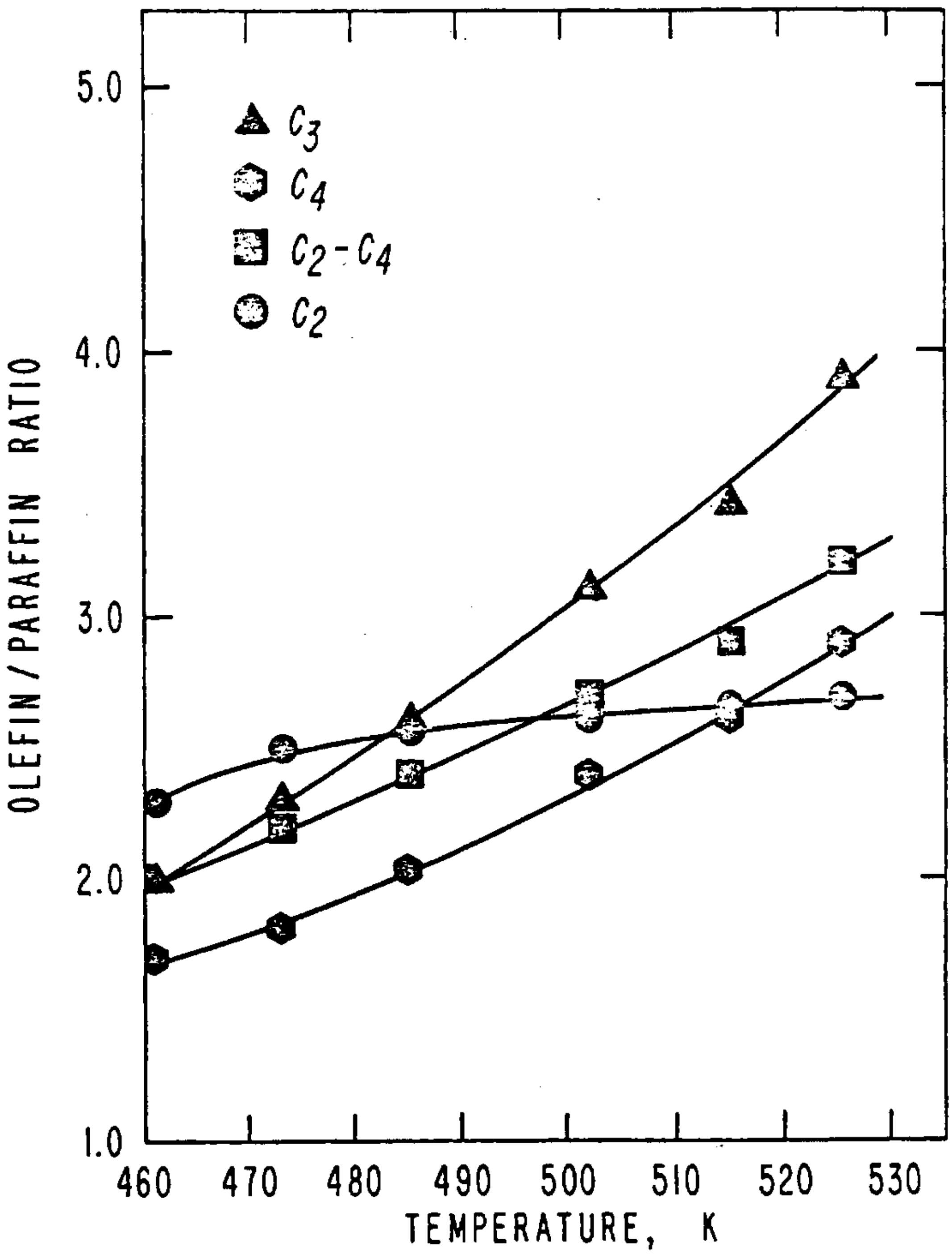
Effect of Temperature on Olefin Selectivity

Diluted Bed Pseudo Slurry Reactor

Pressure = 3200 KPa; H_2/CO = 2/1;

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

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.



5.0
4.0
3.0
2.0
1.0
OLEFIN / PARAFFIN RATIO
C_3
C_4
C_2-C_4
C_2
460
470
480
490
500
510
520
530
TEMPERATURE, K

Figure 50

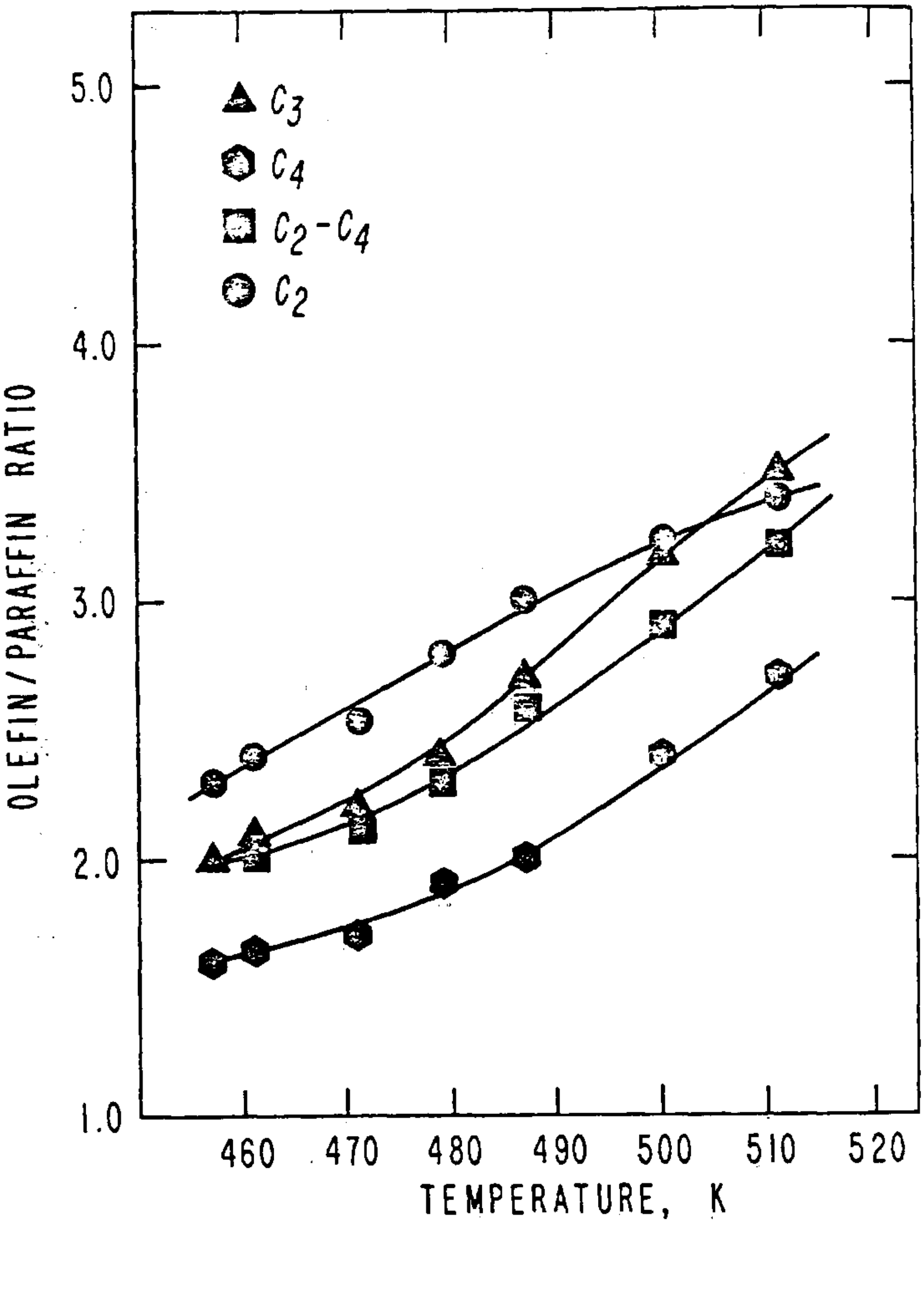
Effect of Temperature on Olefin Selectivity

Diluted Bed Pseudo Slurry Reactor

Pressure = 4400 KPa; $H_2/CO = 2/1$;

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

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.


5.0
4.0
3.0
2.0
1.0
OLEFIN/PARAFFIN RATIO
460
470
480
490
500
510
520
TEMPERATURE, K
C3
C4
C2-C4
C2

As the total reactor pressure increased the olefin to paraffin ratio of the C_3 and C_4 hydrocarbon fractions decreased and that of the C_2 hydrocarbon fraction increased.

The effect of space velocity on carbon monoxide conversion in the diluted bed, pseudo slurry reactor at different total pressures is presented in Figure 51. The conversion of carbon monoxide decreased with increasing space velocity at all reactor pressures investigated. The most significant decline in conversion occurred as the space velocity doubled from 0.5 to 1 $cm^3g^{-1}s^{-1}$. At constant space velocity the conversion of carbon monoxide decreased as the pressure decreased. The effect of space velocity on carbon dioxide yield at different total pressures is presented in Figure 52. The carbon dioxide yield decreased as the space velocity and pressure increased. The product distrubutions as a function of the space velocity at different reactor pressures are presented in Figure 53 through Figure 57. As the space velocity increased, the methane and C_2-C_4 hydrocarbon yields increased; however, above a space velocity of 2 $cm^3g^{-1}s^{-1}$ the yields appeared to stabilize for the C_2-C_4 hydrocarbon fraction. The range of space velocities investigated was expanded to cover an eight fold range (0.5 $cm^3g^{-1}s^{-1}$ up to 4 $cm^3g^{-1}s^{-1}$) at the standard operating conditions, that is, reaction temperature = 493 K, reactor pressure = 2760 KPa, and hydrogen to carbon monoxide ratio = 2/1. The intent of the experiment was to confirm the observations reported for the narrower range of space velocities studied in the process variable investigation. The product distribution are presented in Figure 58 and the selectivity data are presented in Figure 64. The

Figure 51

Effect of Space Velocity on Carbon Monoxide Conversion

Diluted Bed Pseudo Slurry Reactor

Temperature = 503 K; H_2/CO = 2/1;

Pressure = 1400 - 4400 KPa;

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.

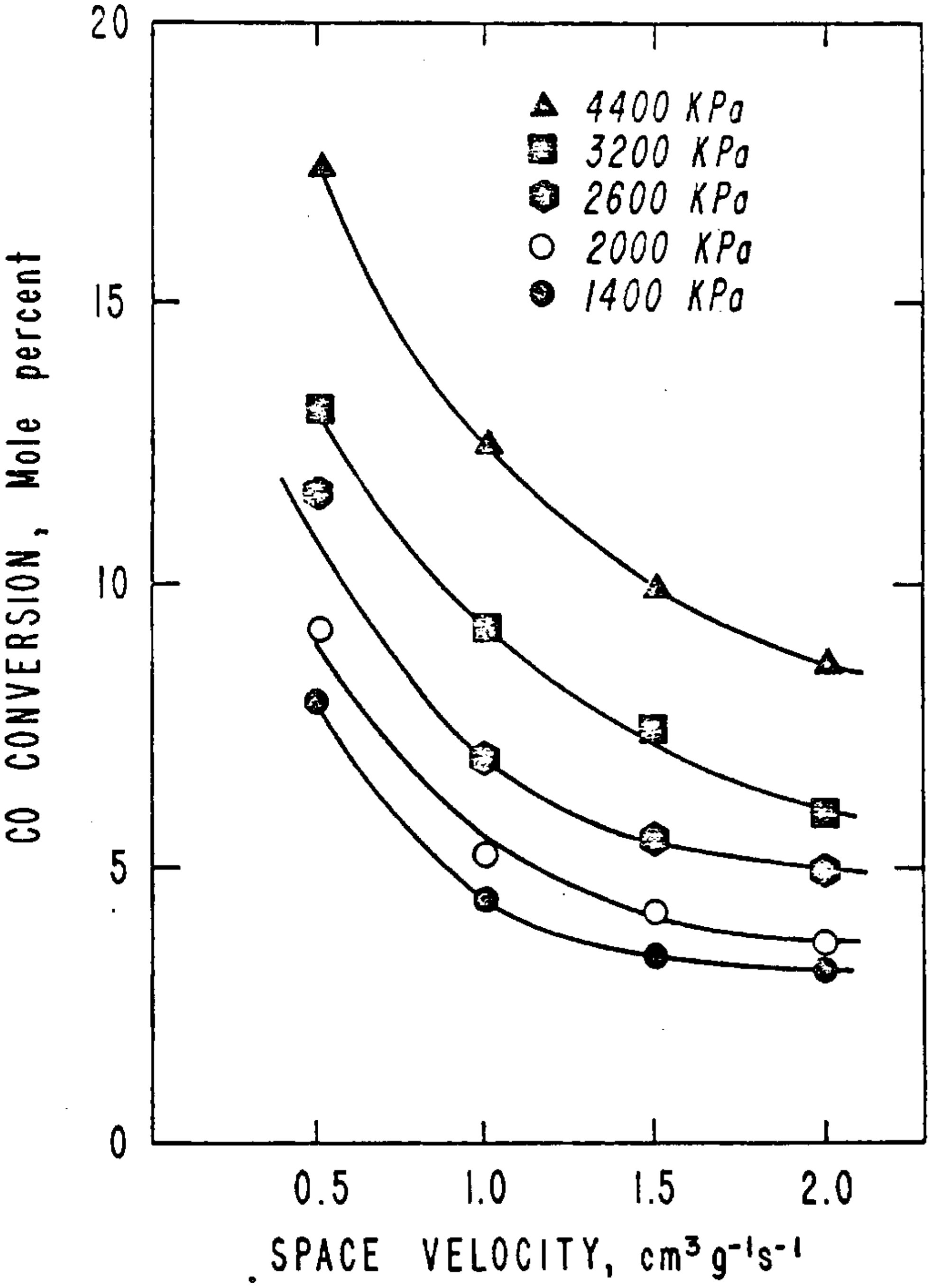

4400 KPa
3200 KPa
2600 KPa
2000 KPa
1400 KPa
CO CONVERSION, Mole percent
0
5
10
15
20
0.5
1.0
1.5
2.0
SPACE VELOCITY, cm³ g⁻¹s⁻¹

Figure 52

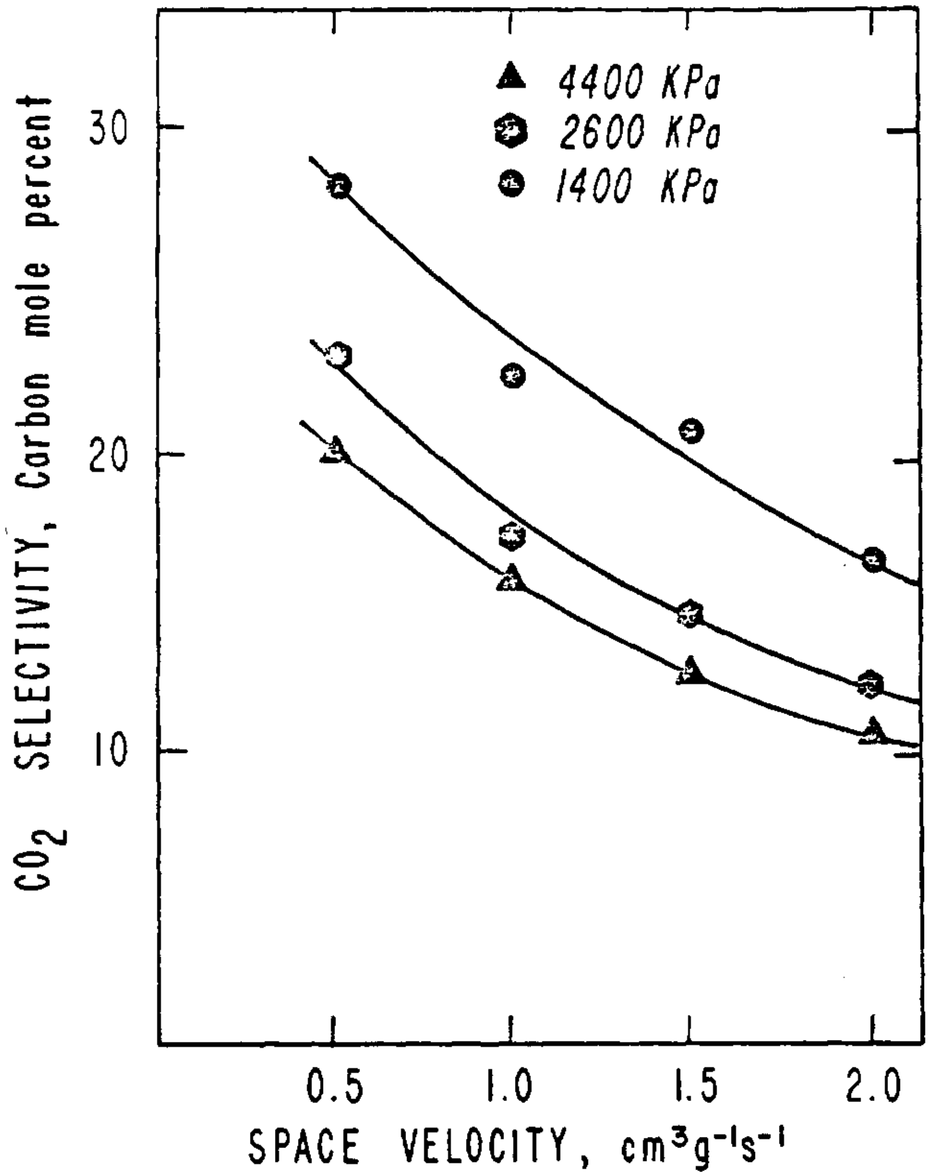
Effect of Space Velocity on Carbon Dioxide Yield

Diluted Bed Pseudo Slurry Reactor

Temperature = 503 K; H_2/CO = 2/1;

Pressure = 1400, 2600 and 4400 KPa;

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.



▲ 4400 KPa
2600 KPa
1400 KPa
30
20
10
CO_2 SELECTIVITY, Carbon mole percent
0.5
1.0
1.5
2.0
SPACE VELOCITY, $cm^3g^{-1}s^{-1}$

Figure 53

Effect of Space Velocity on Product Distribution

Diluted Bed, Pseudo Slurry Reactor

Temperature = 503 K; H_2/CO = 2/1;

Pressure = 1400 KPa;

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.

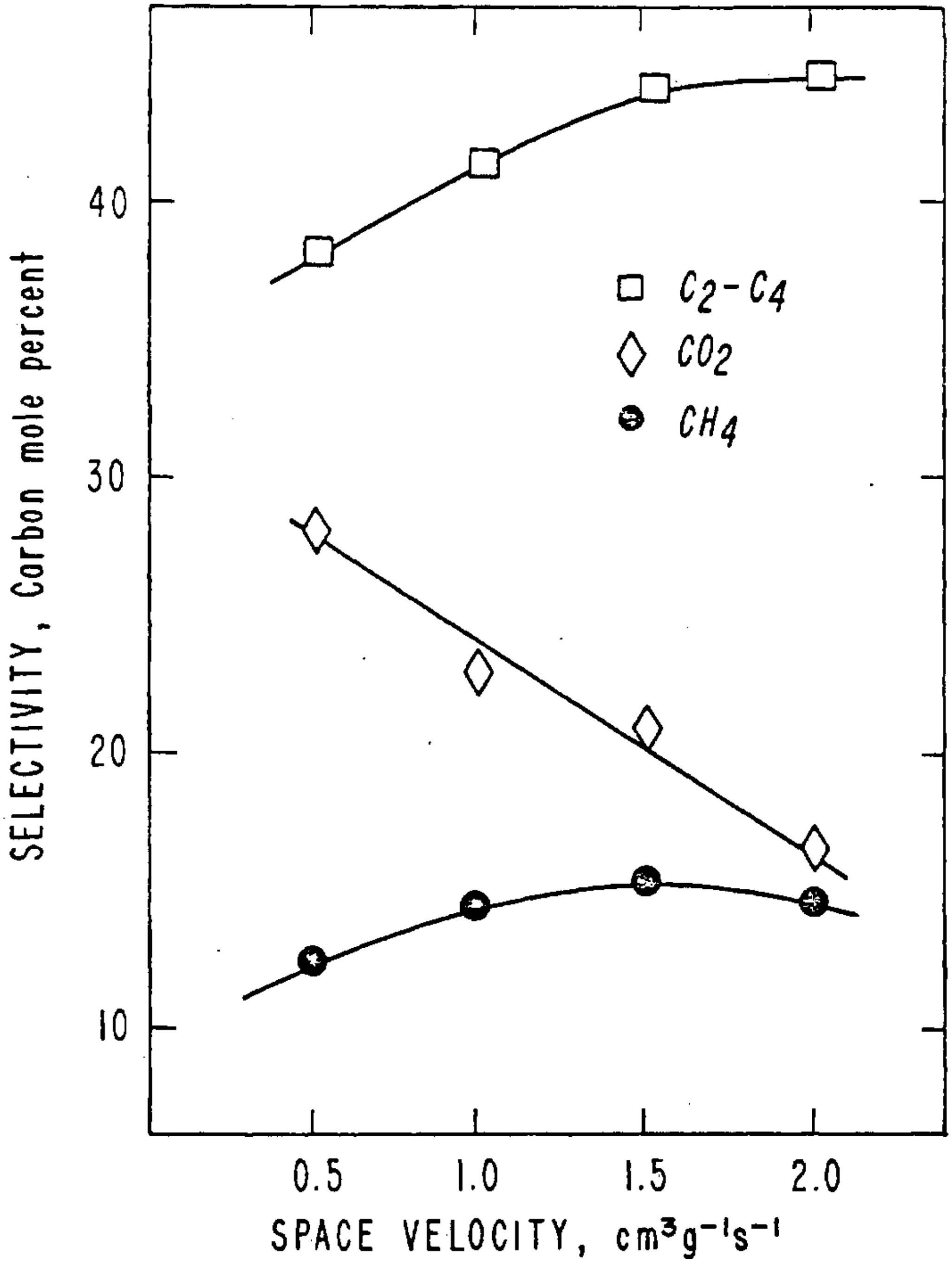

40
30
20
10
0.5
1.0
1.5
2.0
SELECTIVITY, Carbon mole percent
SPACE VELOCITY, cm³g⁻¹s⁻¹
C2-C4
CO2
CH4

Figure 54

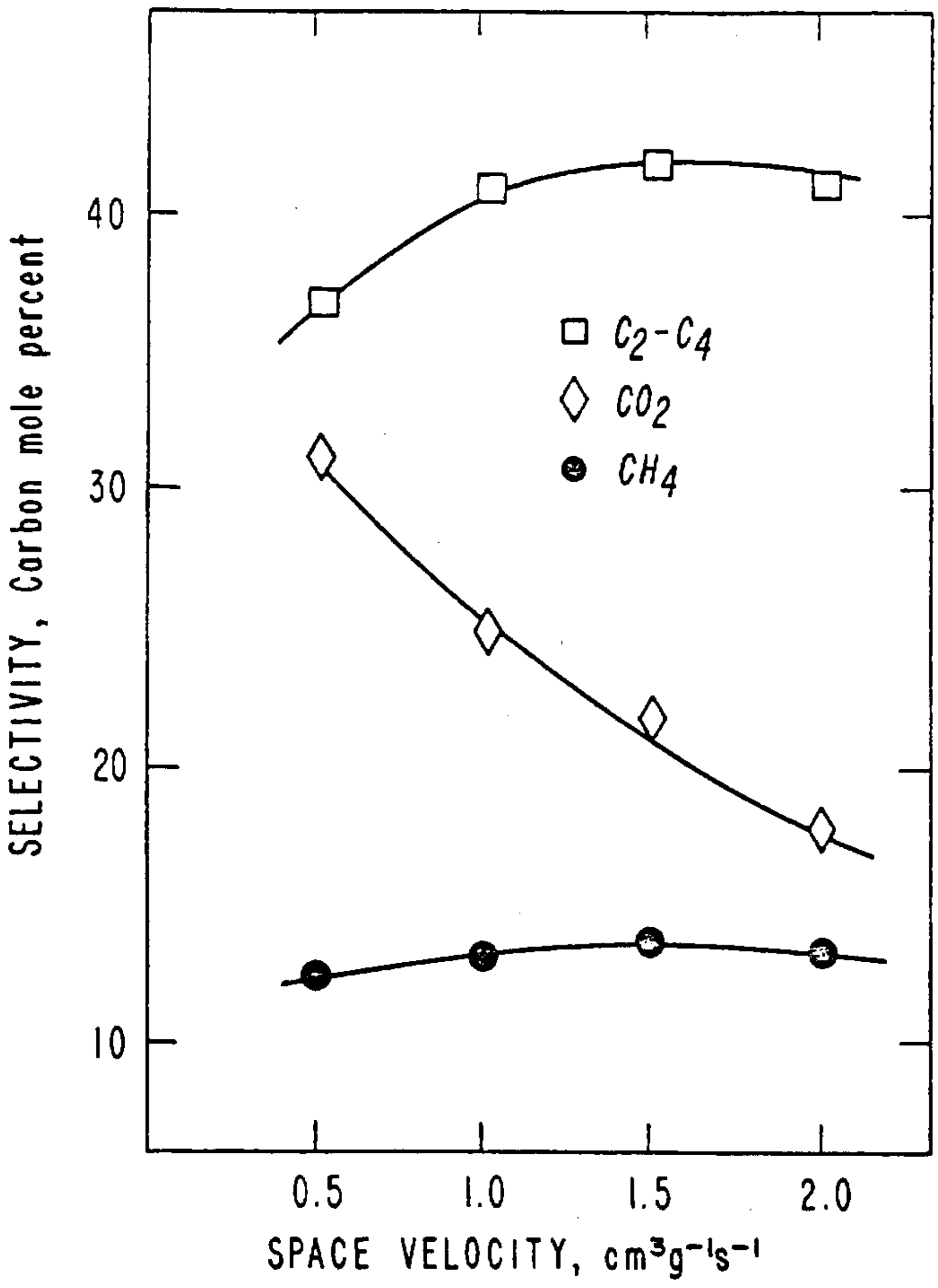
Effect of Space Velocity on Product Distribution

Diluted Bed, Pseudo Slurry Reactor

Temperature = 503 K; H_2/CO = 2/1;

Pressure = 2000 KPa;

Heat Transfer Liquid Flow Rate (n-C16) = 0.103 cm^3s^{-1}.



SELECTIVITY, Carbon mole percent
10
20
30
40
C_2-C_4
CO_2
CH_4
0.5
1.0
1.5
2.0
SPACE VELOCITY, $cm^3g^{-1}s^{-1}$