weight products at high values of P_{H_2}/P_{CO}. Studies of the extent to which 1-alkene incorporation is affected by process variables such as temperature and total pressure may provide fundamental insight into the effects of process variables on the selectivity of the synthesis.

Conclusions

The product distributions of the Fischer-Tropsch synthesis on a cobalt catalyst were studied in a continuous-flow, well-stirred slurry reactor at 220 to 240°C and 0.5 to 1.5 MPa. Synthesis gas with H_2/CO ratios between 1.5 and 3.5 was fed to the reactor over a wide range of space velocities yielding H_2 conversions between 6 and 68% and CO conversions between 11 and 73%.

The relative production of $C_{10}+$ on a weight basis increased with increasing space velocity and decreasing reactor H_2/CO, but was independent of reactor pressure or temperature. Conversely, the relative yield C_1 on a weight basis decreased with increasing space velocity and decreasing reactor H_2/CO, and was also relatively insensitive to reactor pressure or temperature.

Above C_3, the 1-alkene/n-alkane ratio decreased with increasing carbon number. Hydrogenation modelling indicates that a large fraction of the n-alkanes were synthesized by hydrogenation of 1-alkenes, a primary synthesis product. Increasing the reactor H_2/CO ratio decreased the 1-alkene/n-alkane ratio, while increased concentrations of CO in the reactor inhibited the isomerization of 1-alkenes to 2-alkenes.

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Figure Captions

Figure 1 Representative Schulz-Flory Diagram showing a double-α-type distribution (220°C, 1.48 MPa, feed rate = 0.032 Nl/min/gcat). $(H_2/CO)_{in}=1.64$. (H_2/CO) in reactor = 1.65. $\alpha_1=0.54$, $\alpha_2=0.91$, and $\Omega=5.4$.

Figure 2 Representative Schulz-Flory Diagram showing a double-α-type distribution (230°C, 0.79 MPa, feed rate = 0.020 Nl/min/gcat). (H_2/CO) in reactor = 1.39. $(H_2/CO)_{in}=1.55$. $\alpha_1=0.54$, $\alpha_2=0.88$, and $\Omega=5$.

Figure 3 Schulz-Flory diagram for reactor liquid at completion of run. $\alpha_2=0.87$.

Figure 4 The $C_{10}+$ yield is greater at higher space velocities. Data at 240°C, 0.79 MPa, and $(H_2/CO)_{in}=2$.

Figure 5 Pressure has no noticeable effect on the product distribution. Data at 220°C and feed rate of 0.017-0.018 Nl/min/gcat. $(H_2/CO)_{in}=2$.

Figure 6 Temperature has no effect on product distributions. Total synthesis gas conversions are between 31 and 33%, allowing comparison of similar product to reactant ratios.

Figure 7 Weight fraction of C_1 increases with increasing H_2/CO ratio, 220°C.

Figure 8 Weight fraction of $C_{10}+$ decreases with increasing H_2/CO ratio, 220°C.

Figure 9 Component product distribution showing primary products, n-alkanes, 1-alkenes, and n-alcohols (220°C, 1.48 MPa, and feed rate of 0.015 Nl/min/gcat). $(H_2/CO)_{in}=1.66$.

Figure 10 Component product distribution showing primary products, n-alkanes, 1-alkenes, and n-alcohol (240°C, 0.79 MPa, and feed rate of 0.035 Nl/min/gcat). $(H_2/CO)_{in}$=2.15.

Figure 11 The rate of methane plus methanol formation is well fitted by equation 1.

Figure 12 Rate of formation of C_2+ compounds is well fitted by equation 1.

Figure 13 Most ethane is produced from ethene, according to a simple hydrogenation model, data at 220°C.

Figure 14 Most n-butane is produced from 1-butene, according to a simple hydrogenation model, data at 220°C.

Figure 15a Most 2-butene is produced from 1-butene, according to a simple isomerization model (see equation 2), 220°C.

Figure 15b Most 2-butene is produced from 1-butene, according to a simple isomerization model (see equation 2), 240°C.

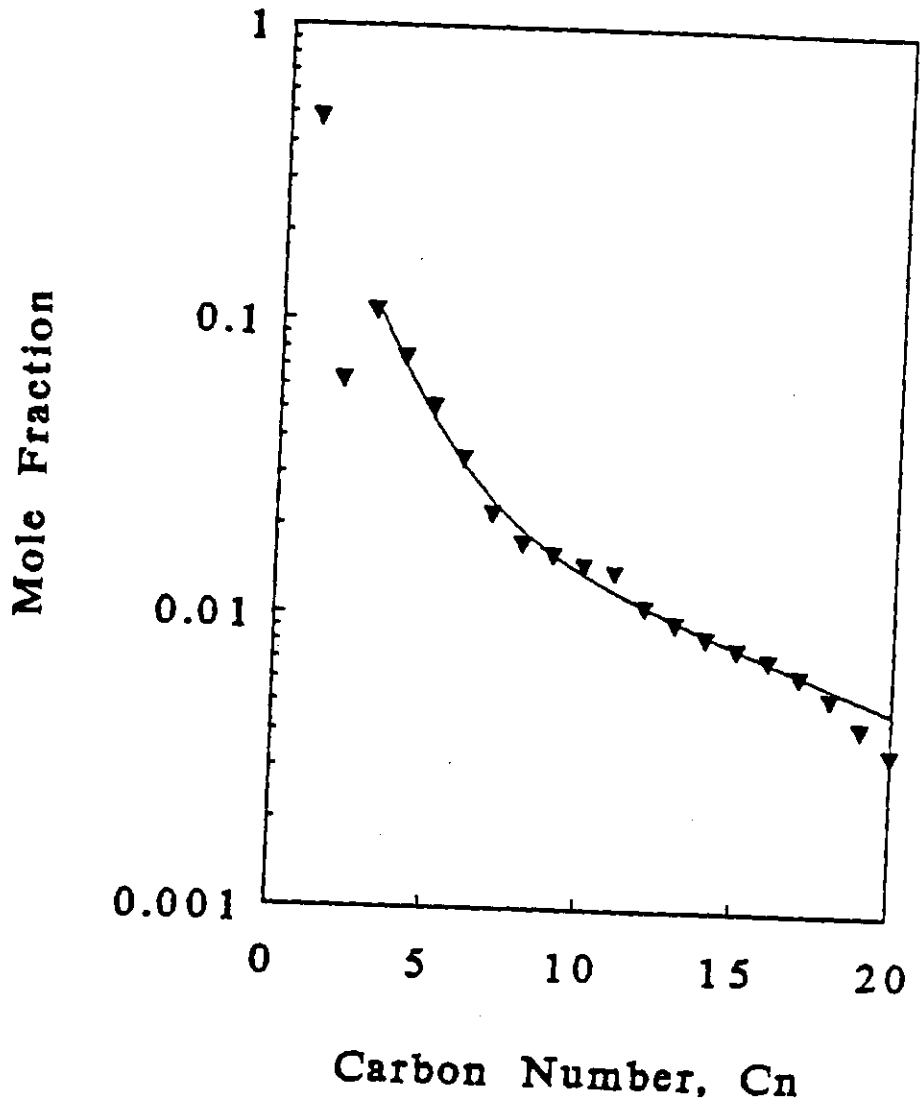

Figure 1 Representative Schulz-Flory Diagram showing a double-α-type distribution (220°C, 1.48 MPa, feed rate = 0.032 Nl/min/gcat). $(H_2/CO)_{in}$ = 1.64. (H_2/CO) in reactor = 1.65. α_1 = 0.54, α_2 = 0.91, and Ω = 5.4.

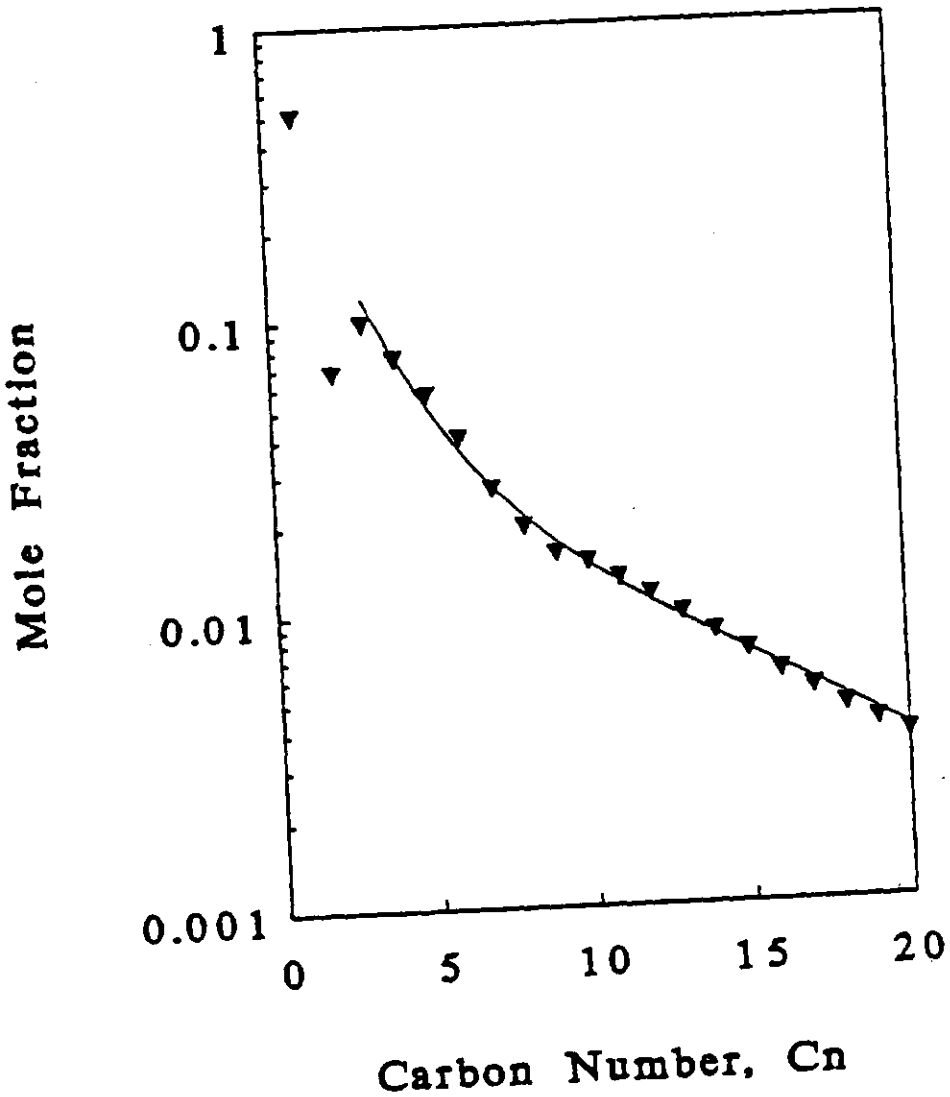

Figure 2 Representative Schulz-Flory Diagram showing a double-α-type distribution (230°C, 0.79 MPa, feed rate = 0.020 Nl/min/gcat). (H_2/CO) in reactor = 1.39. $(H_2/CO)_{in}=1.55$. $\alpha_1=0.54$, $\alpha_2=0.88$, and $\Omega=5$.

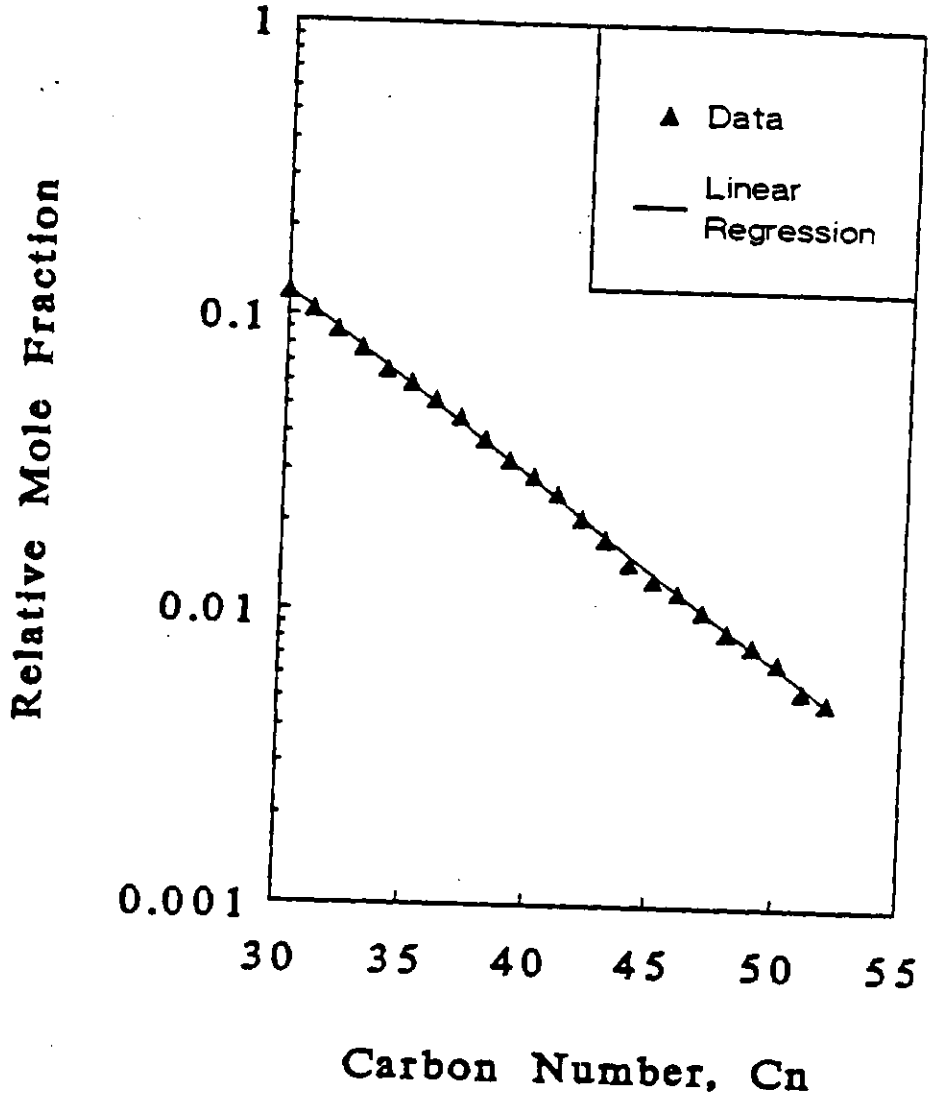

Figure 3 Schulz-Flory diagram for reactor liquid at completion of run. $\alpha_2 = 0.87$

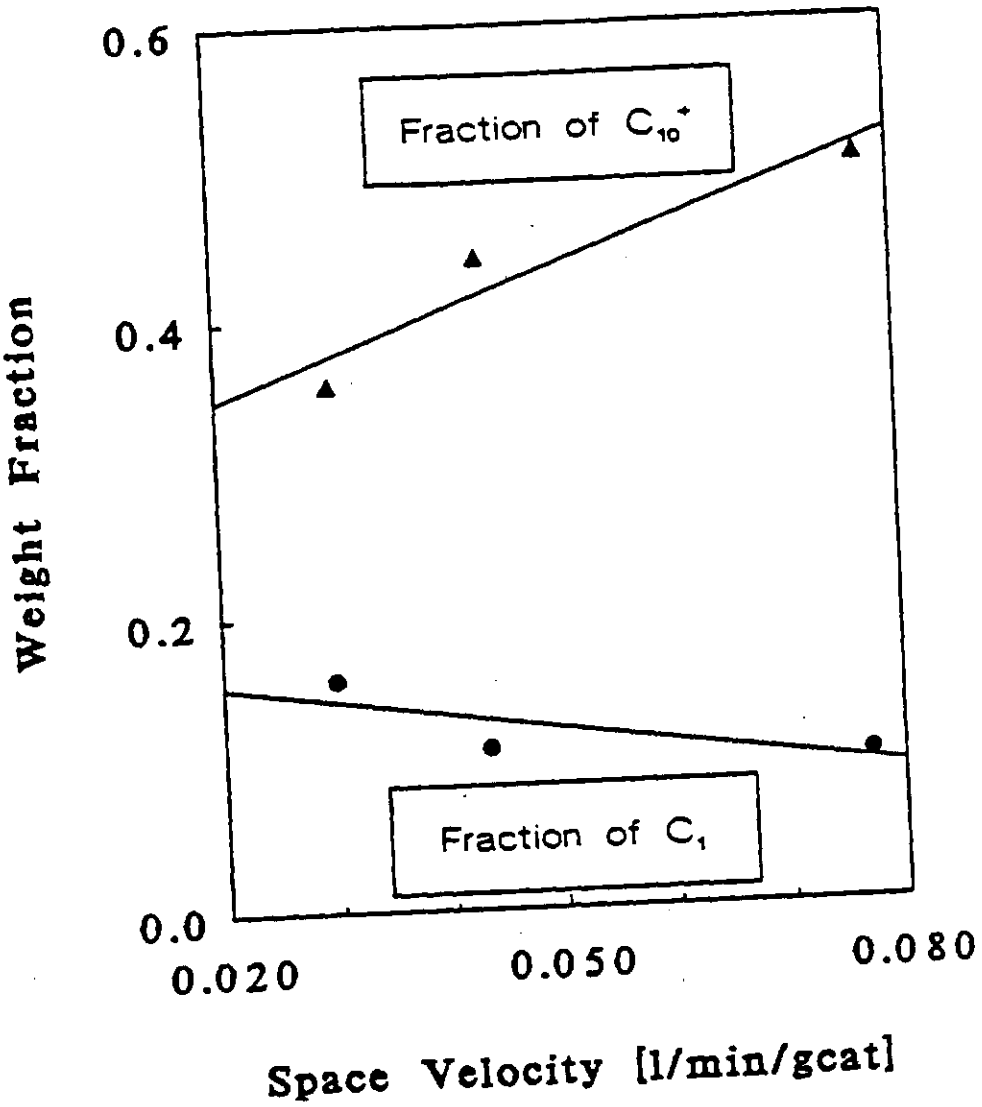

Figure 4 The C_{10}+ yield is greater at higher space velocities. Data at 240°C, 0.79 MPa, and $(H_2/CO)_{in}$=2.

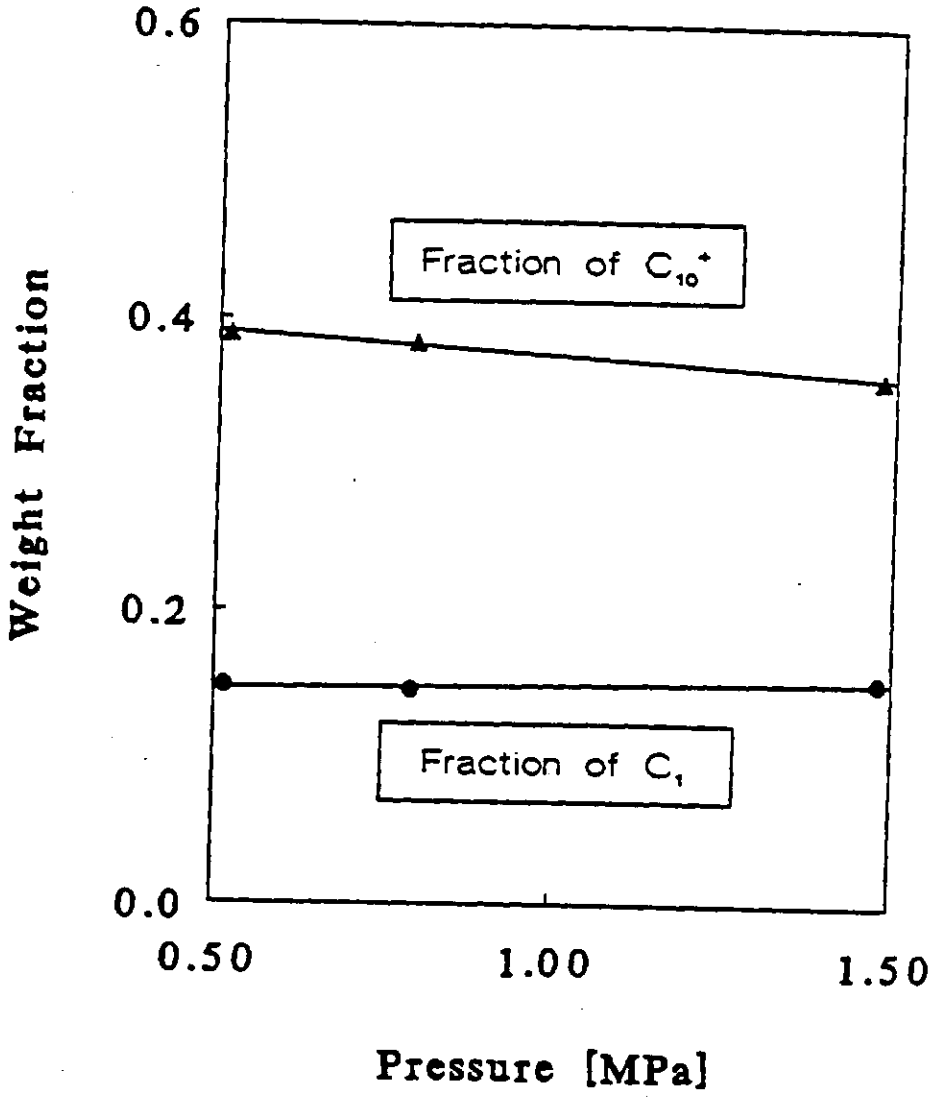

Figure 5 Pressure has no noticeable effect on the product distribution. Data at 220°C and feed rate of 0.017-0.018 Nl/min/gcat. $(H_2/CO)_{in}=2$.

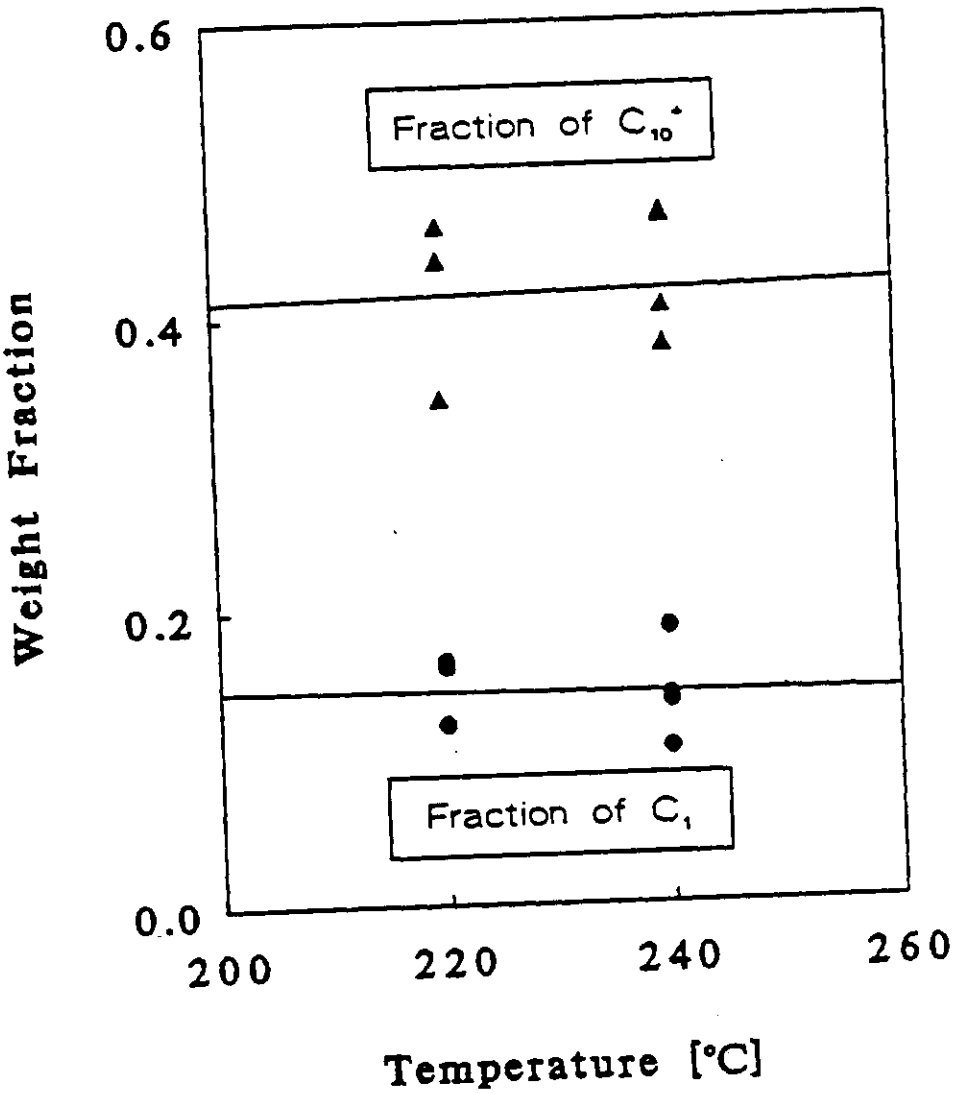

Figure 6 Temperature has no effect on product distributions. Total synthesis gas conversions are between 31 and 33%, allowing comparison of similar product to reactant ratios.

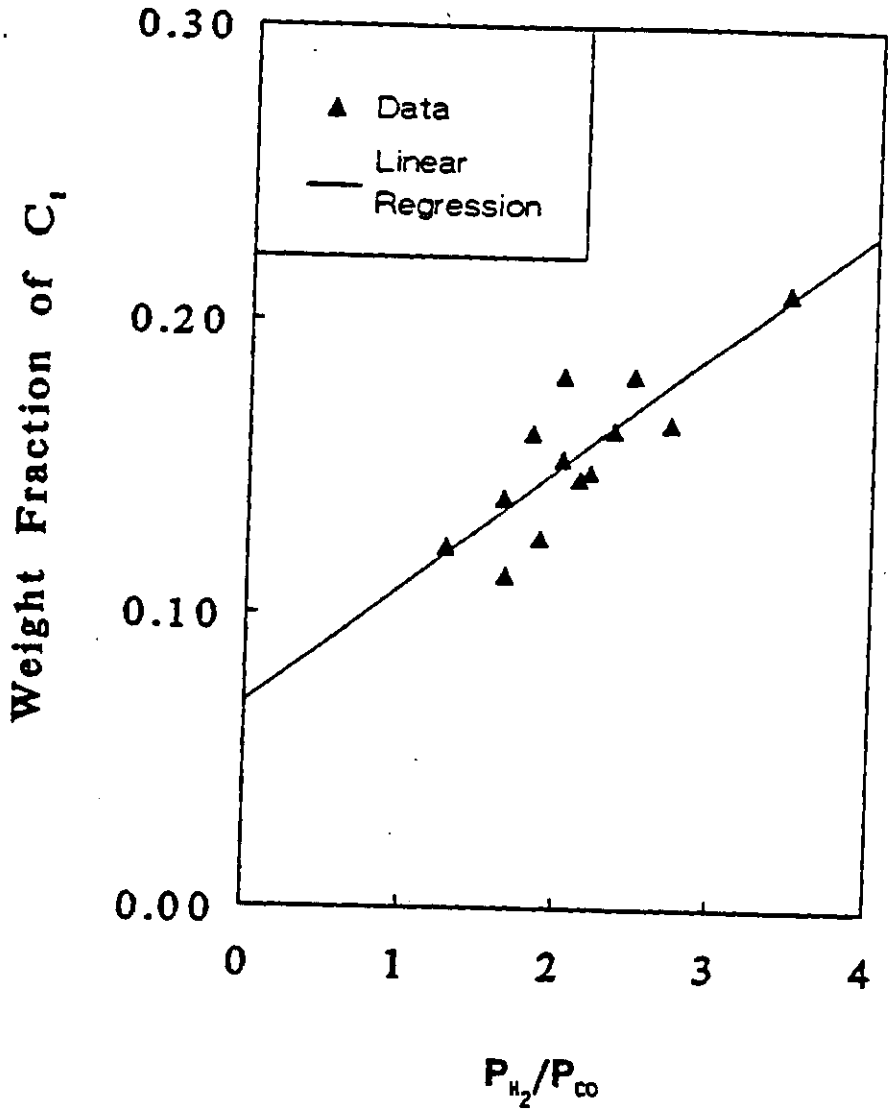

Figure 7 Weight fraction of C_1 increases with increasing H_2/CO ratio, 220°C.

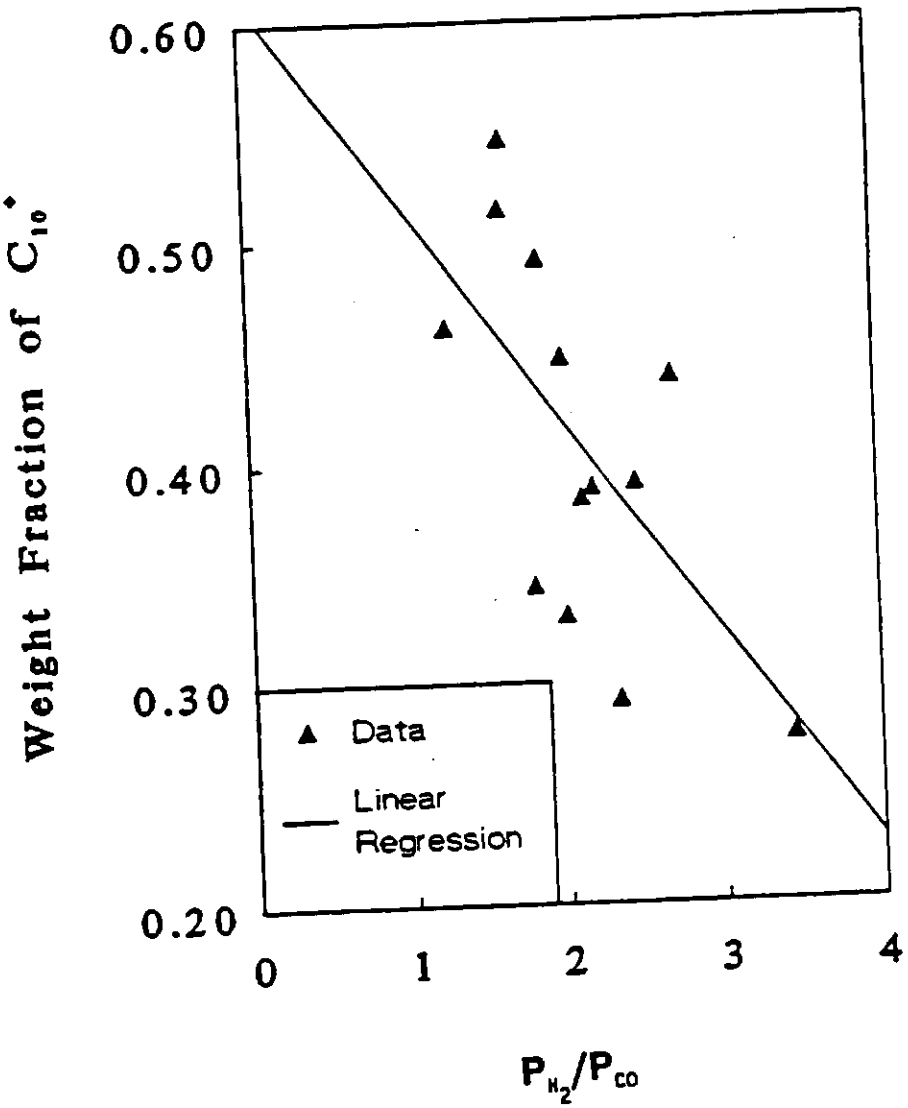

Figure 8 Weight fraction of $C_{10}+$ decreases with increasing H_2/CO ratio, 220°C.

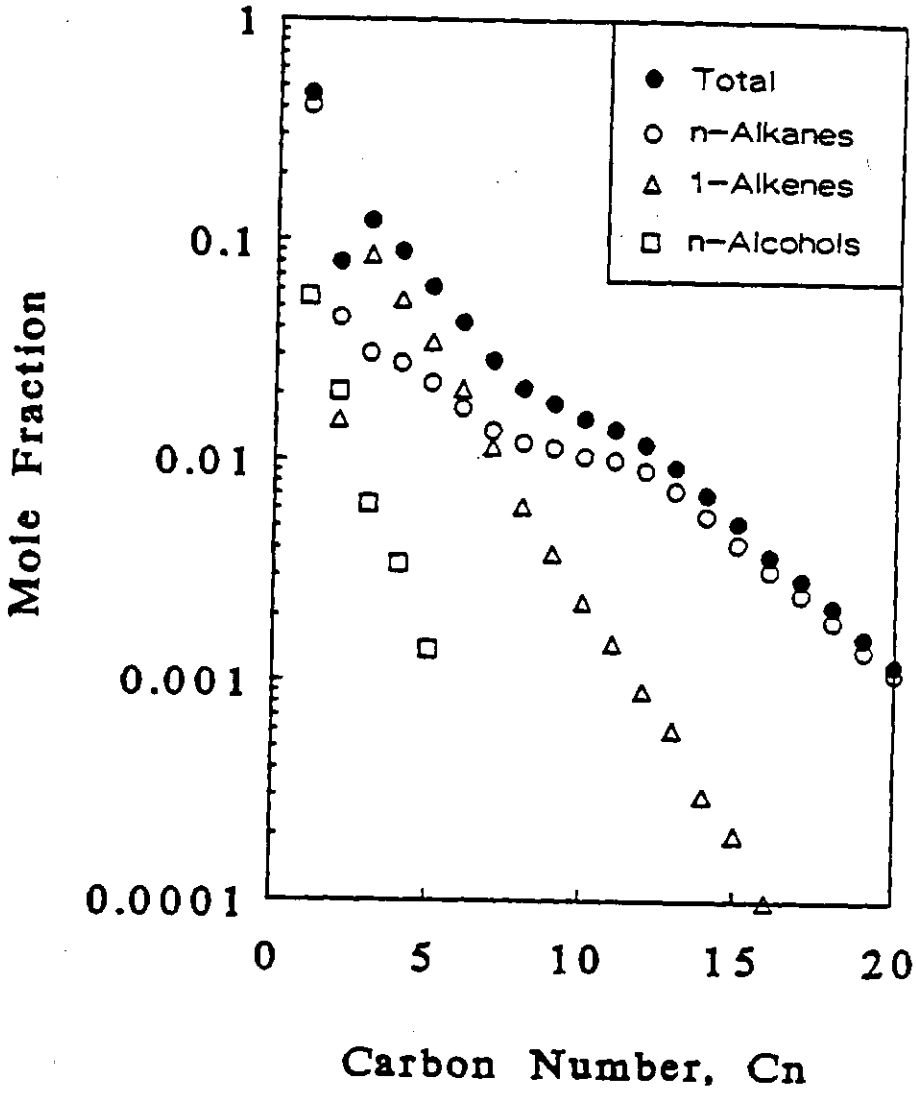

Figure 9 Component product distribution showing primary products, n-alkanes, 1-alkenes, and n-alcohols (220°C, 1.48 MPa, and feed rate of 0.015 Nl/min/gcat). $(H_2/CO)_{in} = 1.66$.

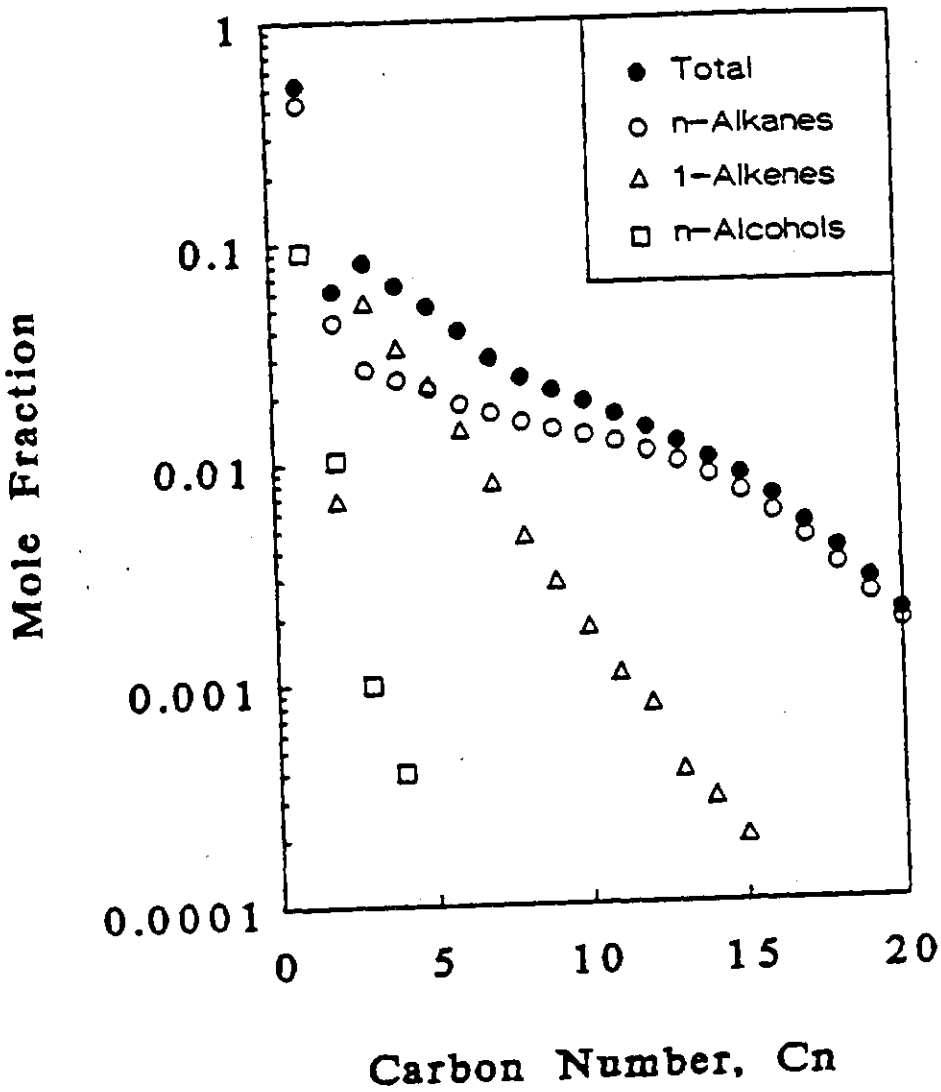

Figure 10 Component product distribution showing primary products, n-alkanes, 1-alkenes, and n-alcohol (240°C, 0.79 MPa, and feed rate of 0.035 Nl/min/gcat). $(H_2/CO)_{in}$=2.15.

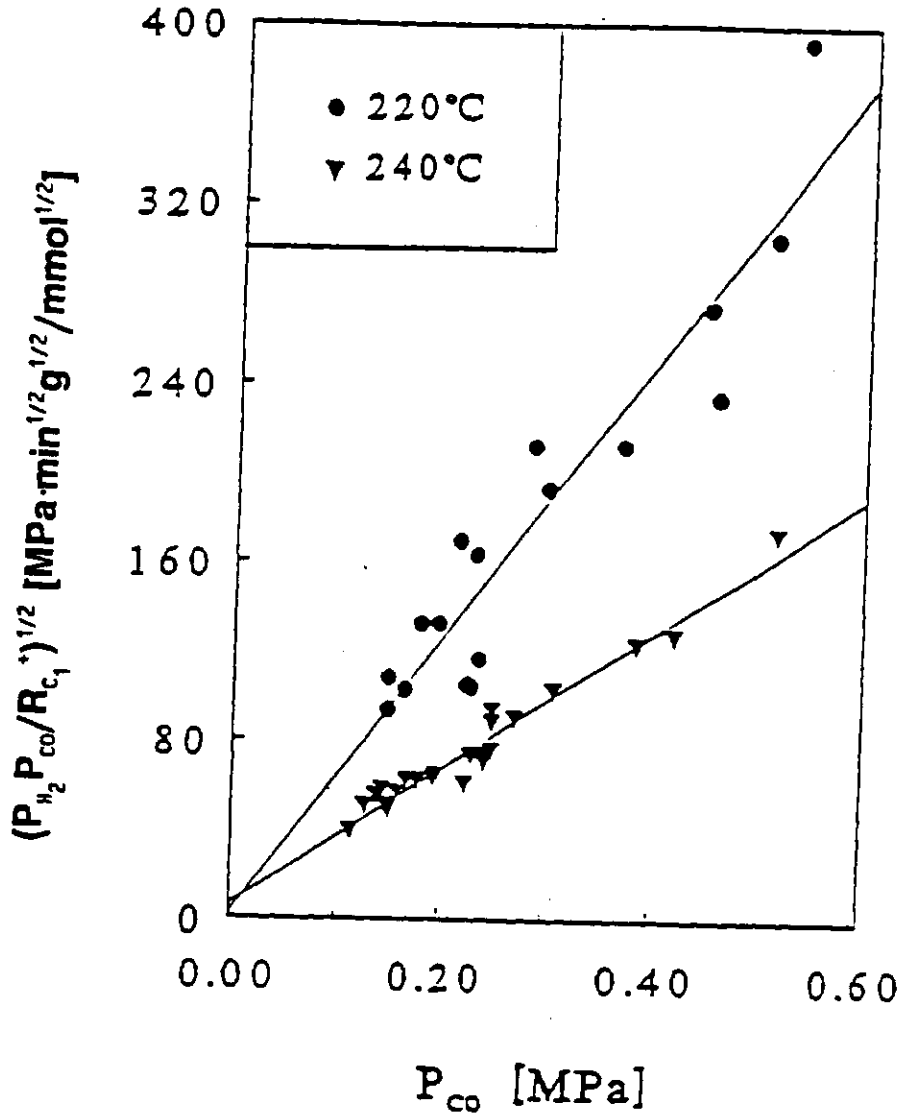

Figure 11 The rate of methane plus methanol formation is well fitted by equation 1.

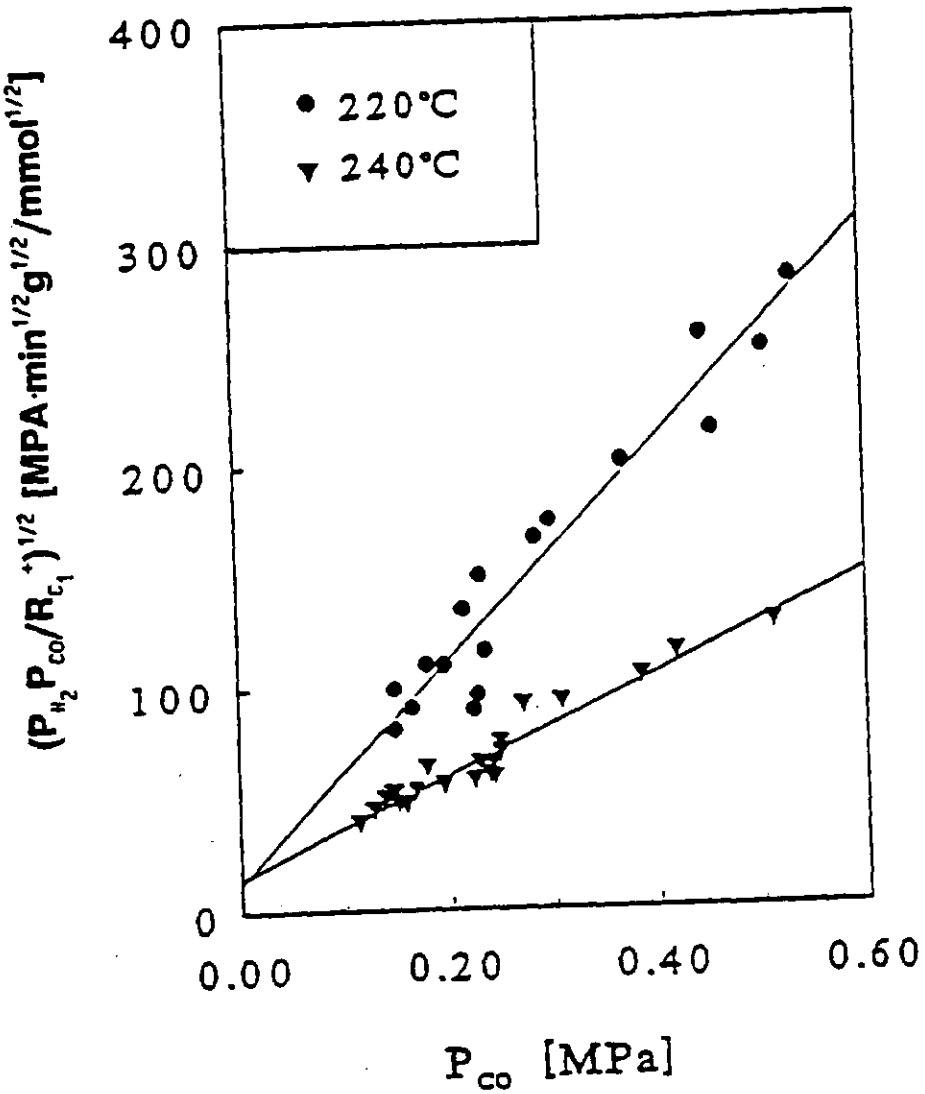

Figure 12 Rate of formation of C_2+ compounds is well fitted by equation 1.

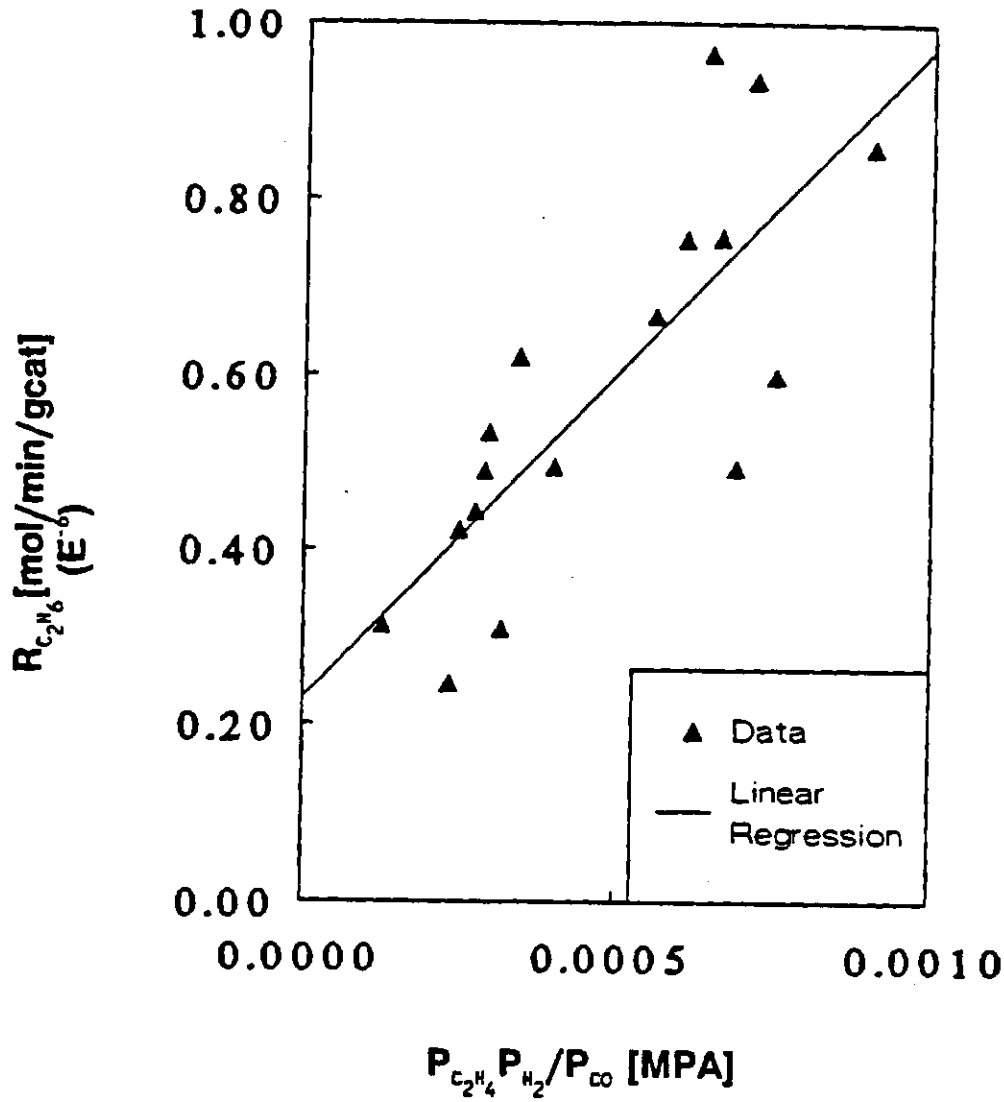

Figure 13 Most ethane is produced from ethene, according to a simple hydrogenation model, data at 220°C.

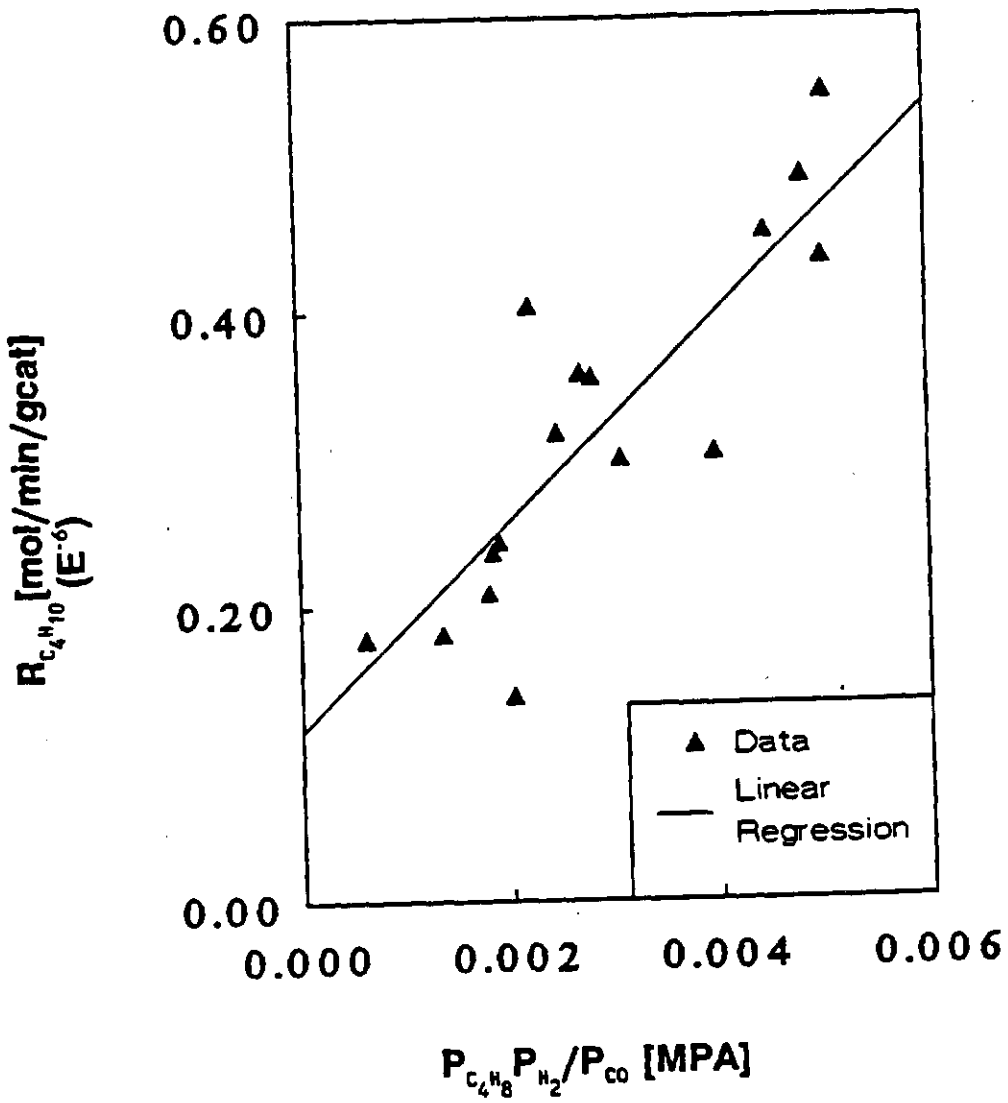

Figure 14 Most n-butane is produced from 1-butene, according to a simple hydrogenation model, data at 220°C.

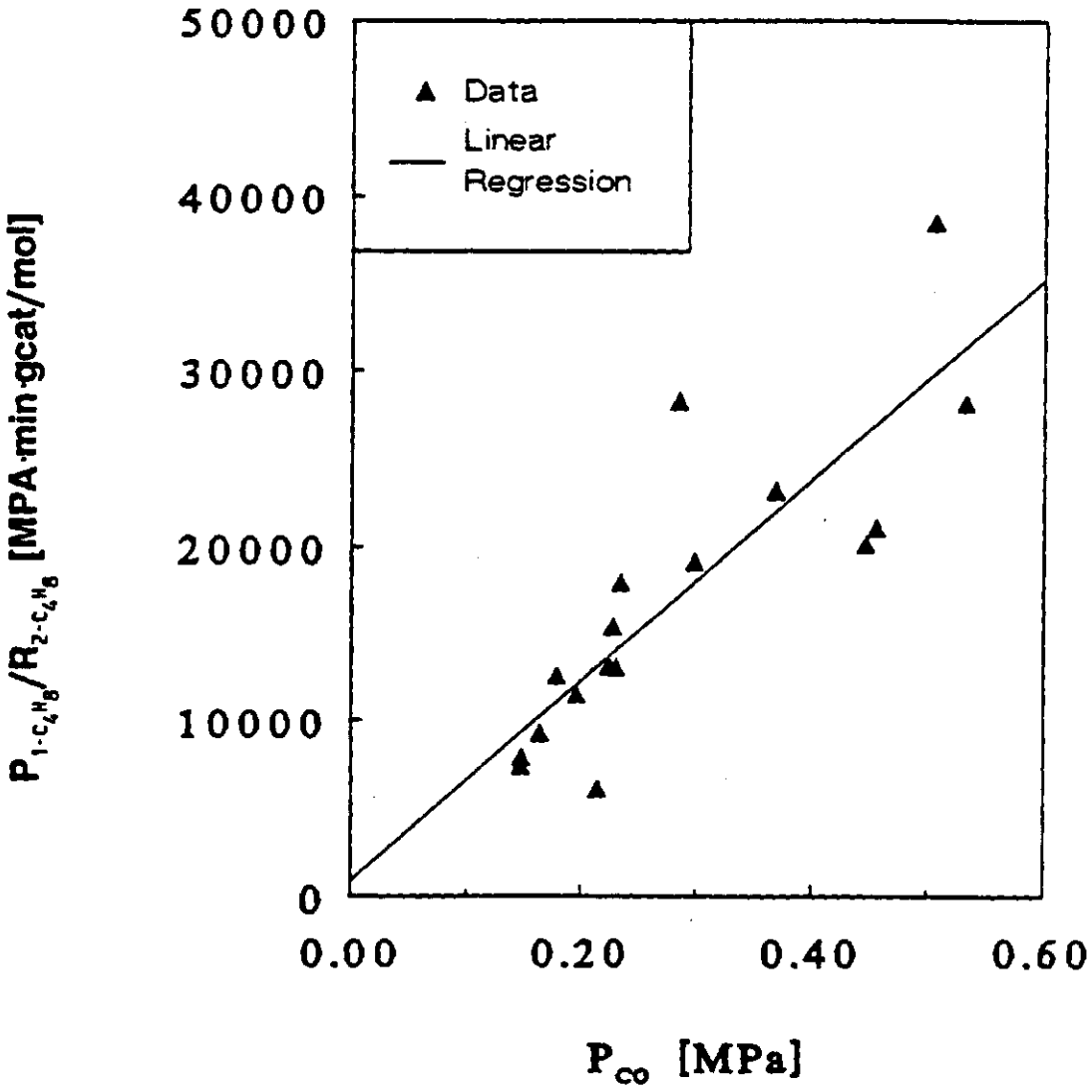

Figure 15a Most 2-butene is produced from 1-butene, according to a simple isomerization model (see equation 2), 220°C.

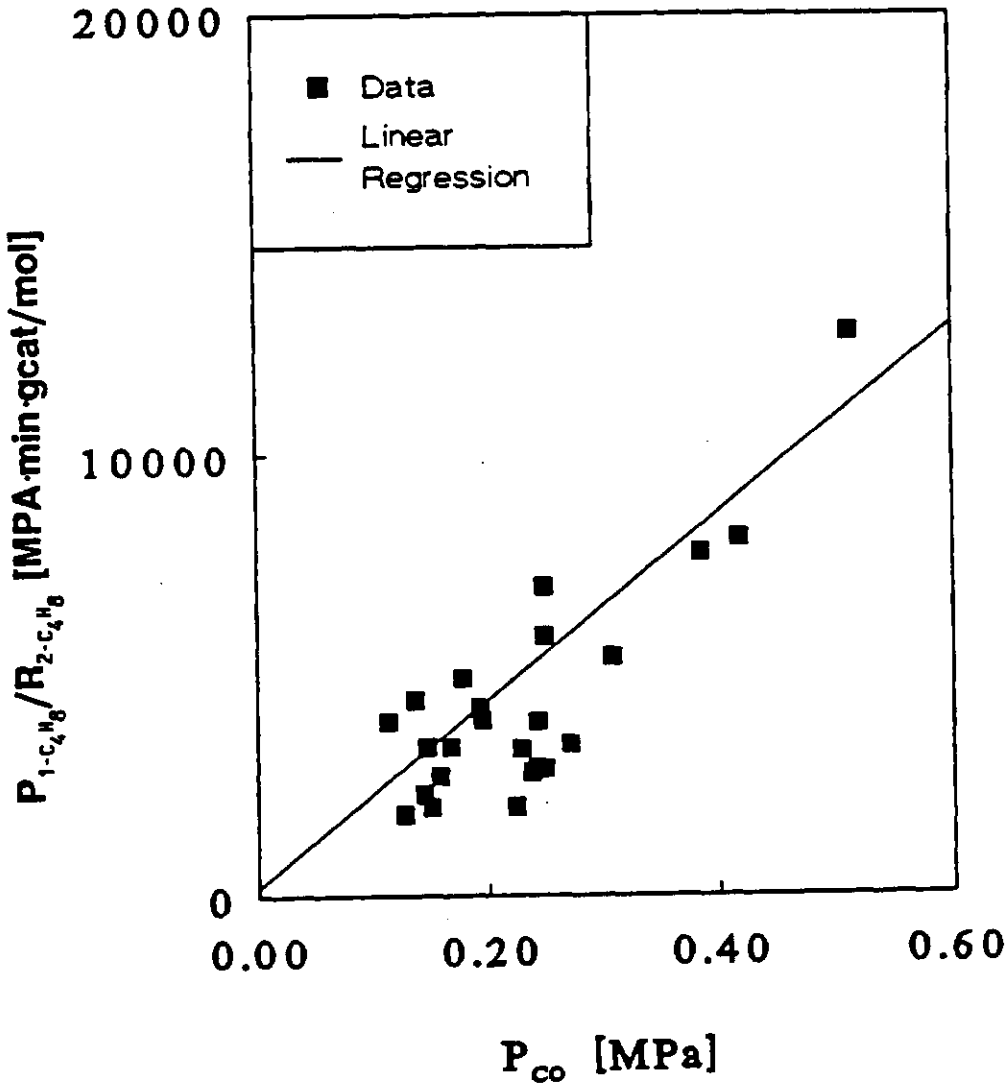

Figure 15b Most 2-butene is produced from 1-butene, according to a simple isomerization model (see equation 2), 240°C.