increasing conversion. Consequently, the decrease in methane production for these catalyst at higher conversions is expected.

Figures 4.3.15 through 4.3.18 are plots of the methane yields for the Fe, Co and FeCo catalysts, respectively, at 1 and 14 atmospheres. For both pure component catalysts there is a significant reduction in the methane yield with increasing pressure. At 3% CO conversion the decrease for Fe is approximately 37% relative to the yeild obtained at one atmosphere (Figure 4.3.16). The corresponding decrease for the Co catalyst is approximately 30% (Figure 4.3.17). On the other hand the reduction in the methane yield for the alloy catalyst is much smaller. The yield at 14 atmospheres decreases to only 12% of the value obtained at 1 atmosphere at 3% CO conversion (Figure 4.3.18). The methanation kinetics of the FeCo catalyst are the least sensitive to changes in the total pressure for the 1/3 feed.

4.3.6 Low Molecular Weight Olefin/Paraffin Yields and Selectivities Using the 1/1 CO/H_2 Feed

The ethylene and propylene yields of all three catalyst are presented in Figures 4.3.19 and 4.3.20 respectively for the 1/1 CO/H_2 mixture at one atmosphere. The Fe and FeCo catalysts produce similar yields of these components while the Co catalyst yields about 20% less propylene for a given CO conversion. The ethylene yield of the Co catalyst with this feed exhibits the same trend observed with the 1/3 feed with increasing CO conversion.

The $N_{C_2^=}/N_{C_2}$ and $N_{C_3^=}/N_{C_3}$ ratios are presented in Figure 4.3.21 for one atmosphere pressure. All three catalysts exhibit similar ratios for the C_2 products indicating similar ethylene production and consumption rates at these conditions. It is interesting to note that the increases

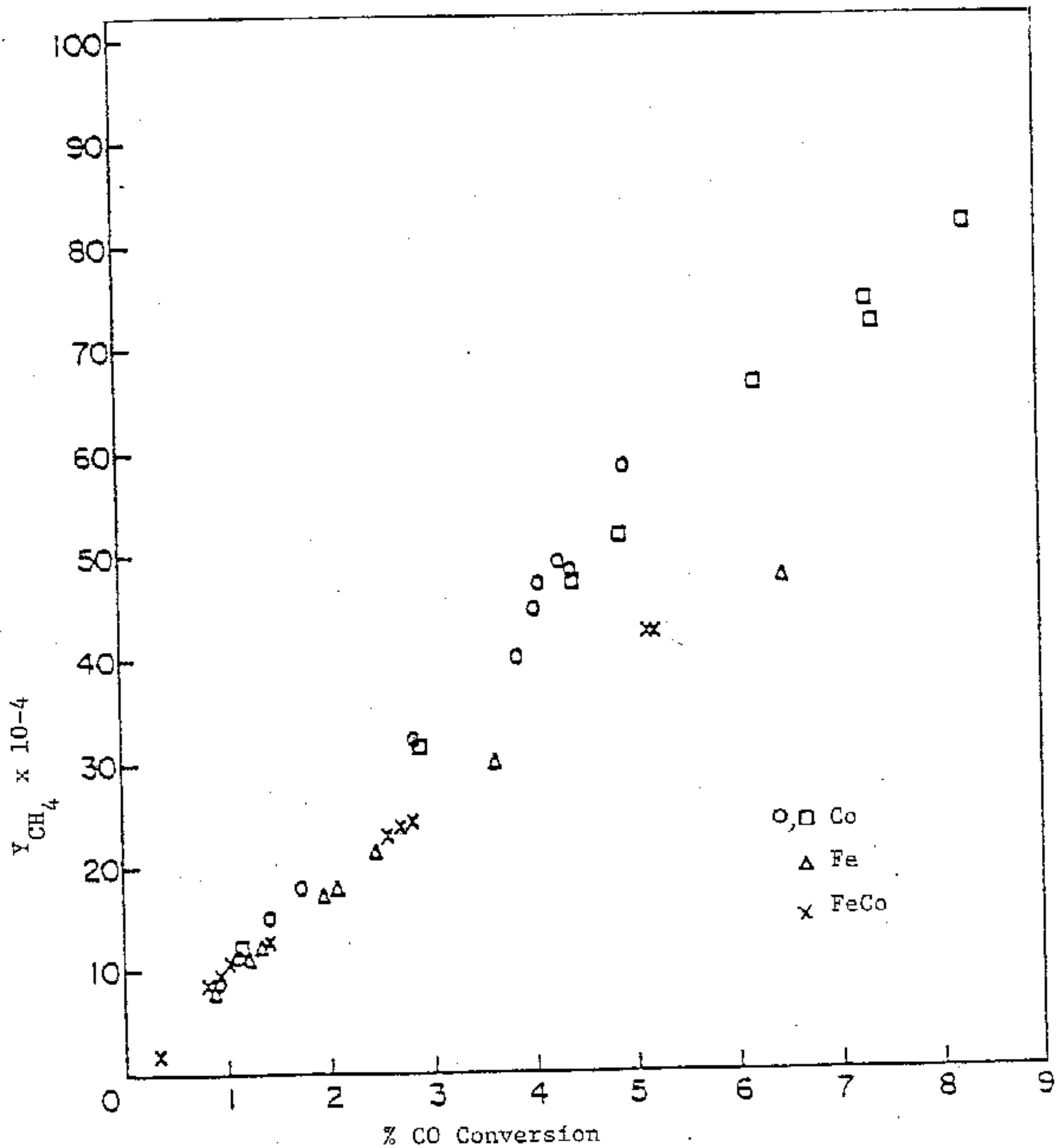

Figure 4.3.15 Methane yield versus % CO conversion for the Fe, Co, and FeCo catalyst at 1 atm. in the 1/3 CO/H_2 feed.

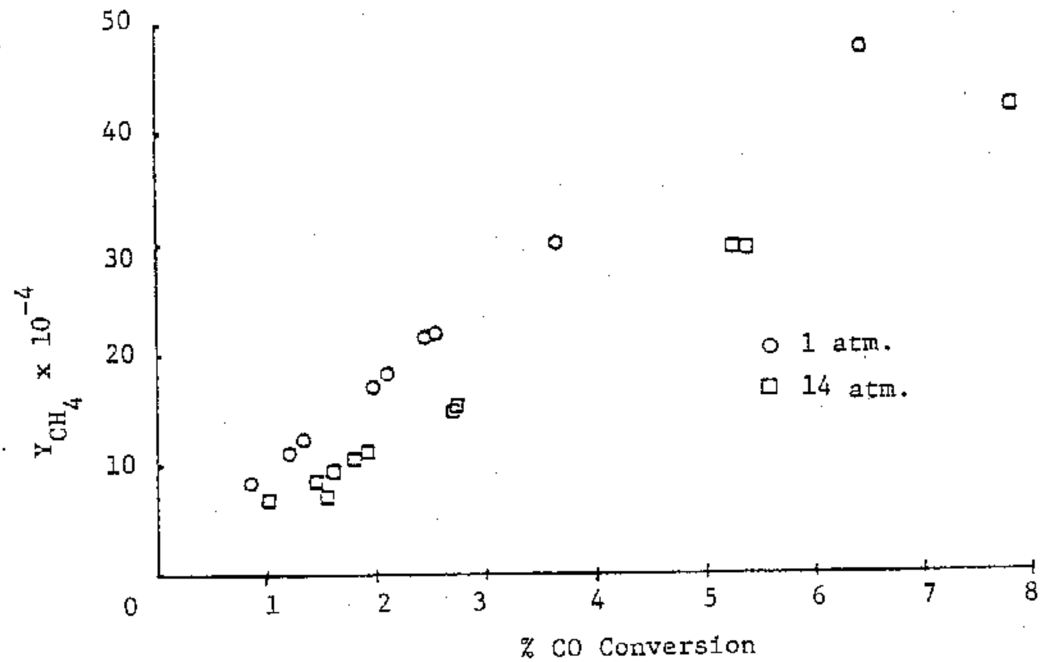

Figure 4.3.16 Methane yield versus % CO conversion for the Fe catalyst at 1 and 14 atmospheres in the 1/3 CO/H_2 feed.

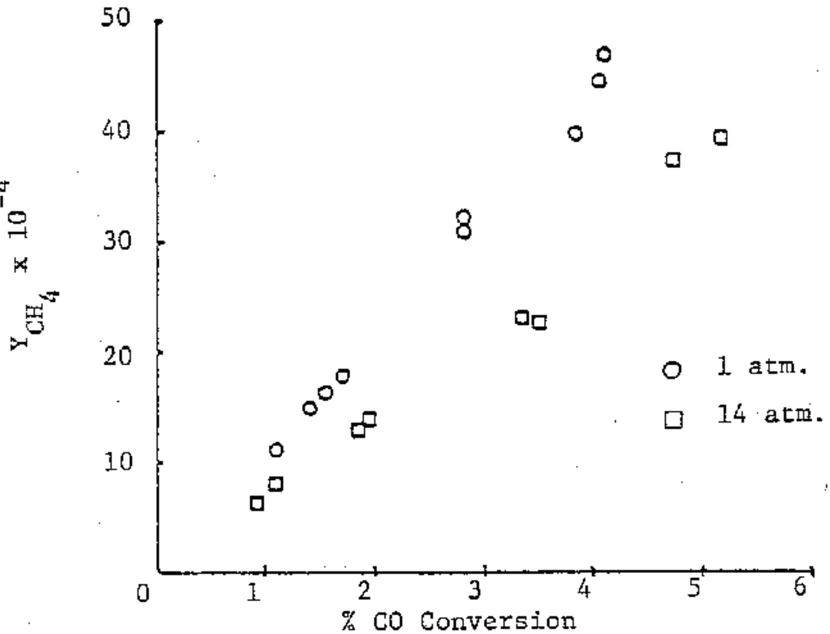

Figure 4.3.17 Methane yield versus % CO conversion for the Co catalyst at 1 and 14 atmospheres in the 1/3 CO/H_2 mixture.

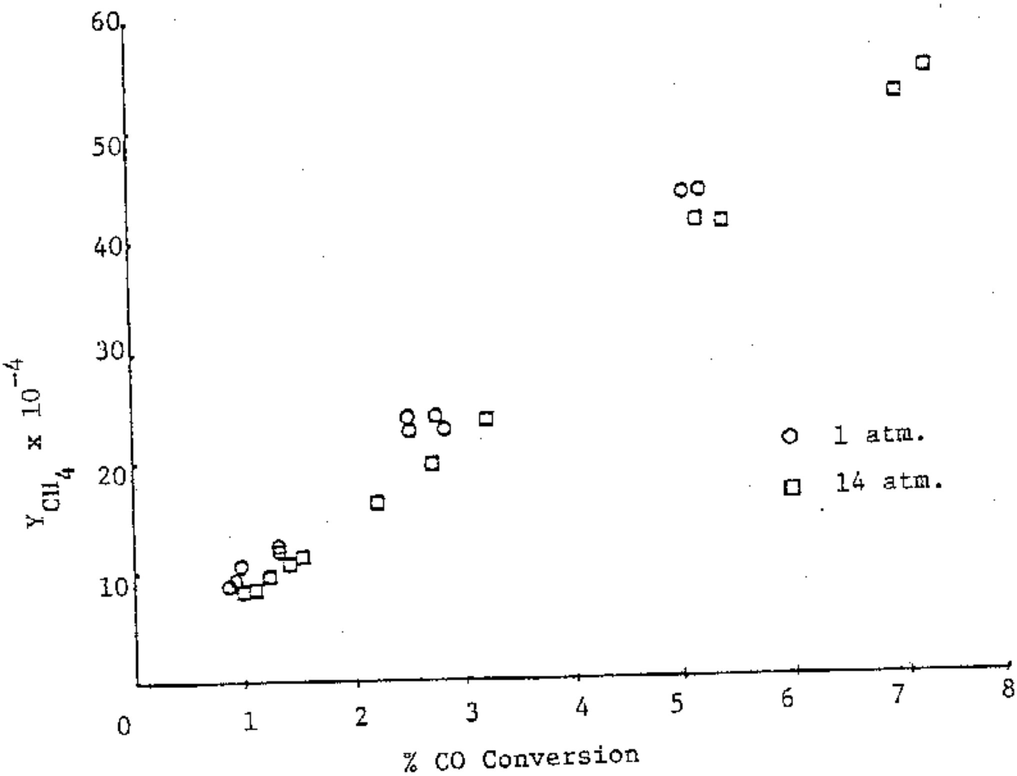

Figure 4.3.18 Methane yield versus % CO conversion for the FeCo catalyst at 1 and 14 atmospheres in the 1/3 CO/H_2 mixture.

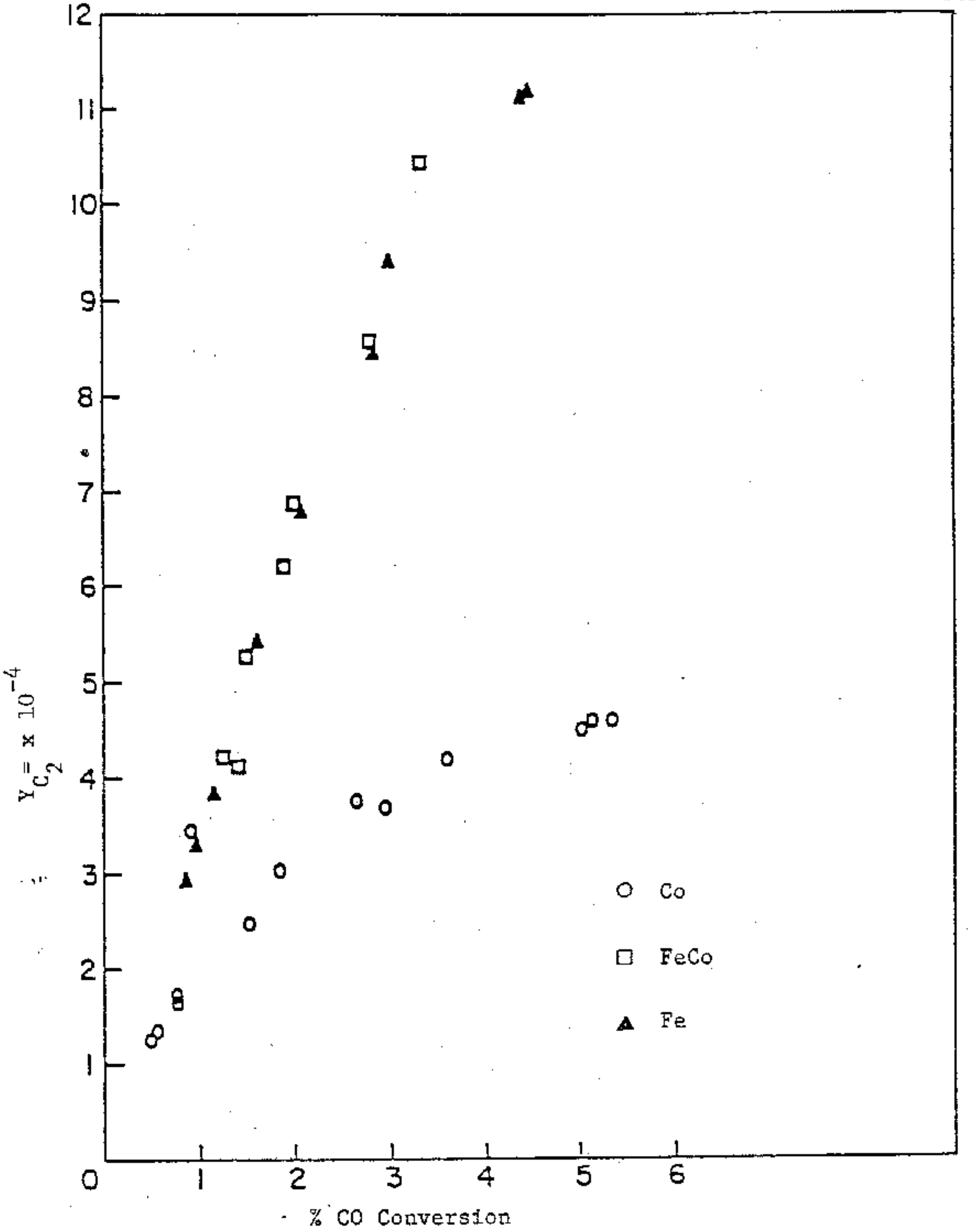

Figure 4.3.19 Ethylene yield as a function of percent conversion for all three catalysts using the 1/1 CO/H_2 feed at 1 atm. and 250°C.

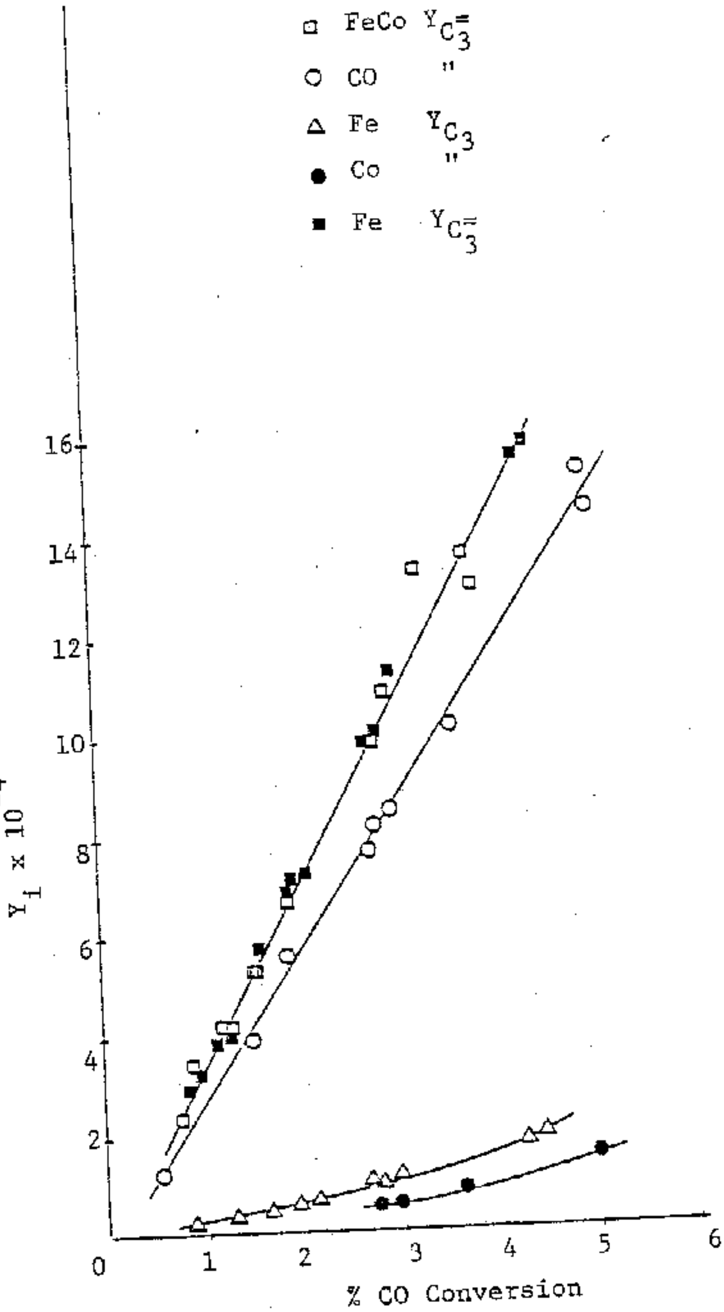

Figure 4.3.20 Propylene ($Y_{C_3^=}$) and propane (Y_{C_3}) yields as a function of percent CO conversion at 1 atm. and 250°C using the 1/1 CO/H_2 feed.

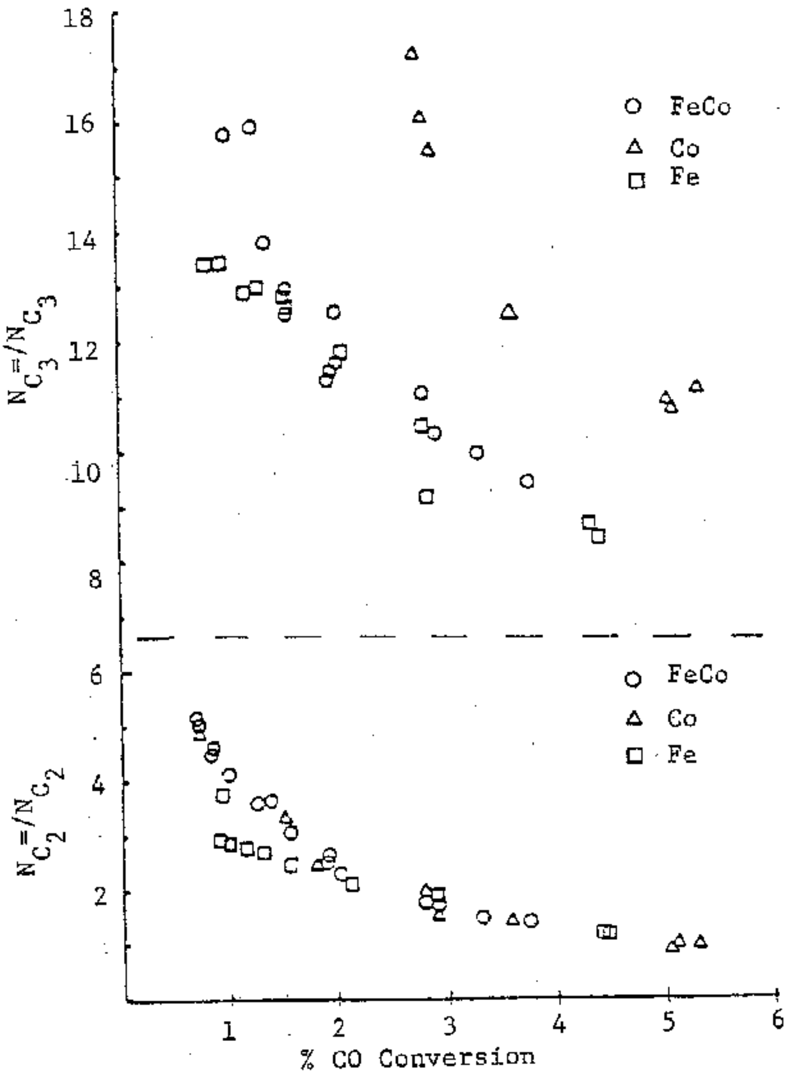

Figure 4.3.21 $N_{C_3^=}/N_{C_3}$ (top) and $N_{C_2^=}/N_{C_2}$ (bottom) for all three catalyst at 1 atm. in the 1/1 CO/H_2 mixture.

with the 1/3 feed are 160% for Fe as compared to 14% for the Co and FeCo catalysts (comparison made at 3% CO conversion). Both Fe and FeCo give similar $N_{C_3^=}/N_{C_3}$ values at these conditions while the Co catalyst again has the highest ratios of this olefin. Comparing these olefin to paraffin ratios with those obtained with the 1/3 mixture one observes an increase in ratio values with the richer CO feed. At 3% CO conversion the percent increase in $N_{C_3^=}/N_{C_3}$ values relative to those obtained with the 1/3 feed (Figure 4.3.8) are 120% for Fe, 31% for FeCo and 42% for Co. Based on the increase in the $N_{C_2^=}/N_{C_2}$ and $N_{C_3^=}/N_{C_3}$ ratios for all three catalysts, with the 1/1 feed, it appears that the net low molecular weight olefin production rate of the Fe catalyst has the greatest CO partial pressure dependence among all three catalyst.

Figures 4.3.22, 4.3.23, and 4.3.24 present the ethylene, propylene, and 1-butene yields respectively as a function of CO conversion for the FeCo catalyst at 1, 7.8 and 14 atmospheres. The Fe catalyst produced comparable yields to that of the alloy catalyst except at 14 atmospheres where the propylene yield of the FeCo catalyst is slightly higher than that of pure iron (Figure 4.3.25). Figure 4.3.26 presents the ethylene and propylene yields for the Co catalyst at 1 and 7.8 atmospheres. The trends on olefin yields with increasing CO conversion for the 1/1 mixture are similar to those obtained with the 1/3 feed. Figures 4.3.27 and 4.3.28 are plots of the $N_{C_2^=}/N_{C_2}$ and $N_{C_3^=}/N_{C_3}$ ratios respectively at 7.8 atmospheres. Increasing pressure reduces the $N_{C_2^=}/N_{C_2}$ ratio for the alloy catalyst while the ratio remains essentially constant for the pure component catalyst. (Compare $N_{C_2^=}/N_{C_2}$ ratios in Figures 4.3.21 and 4.3.25) Since the ethylene yield is the same for the Fe and FeCo catalysts, the alloy catalyst has a much higher selectivity towards in the $N_{C_2^=}/N_{C_2}$ values with the 1/1 CO/H_2 feed relative to those obtained

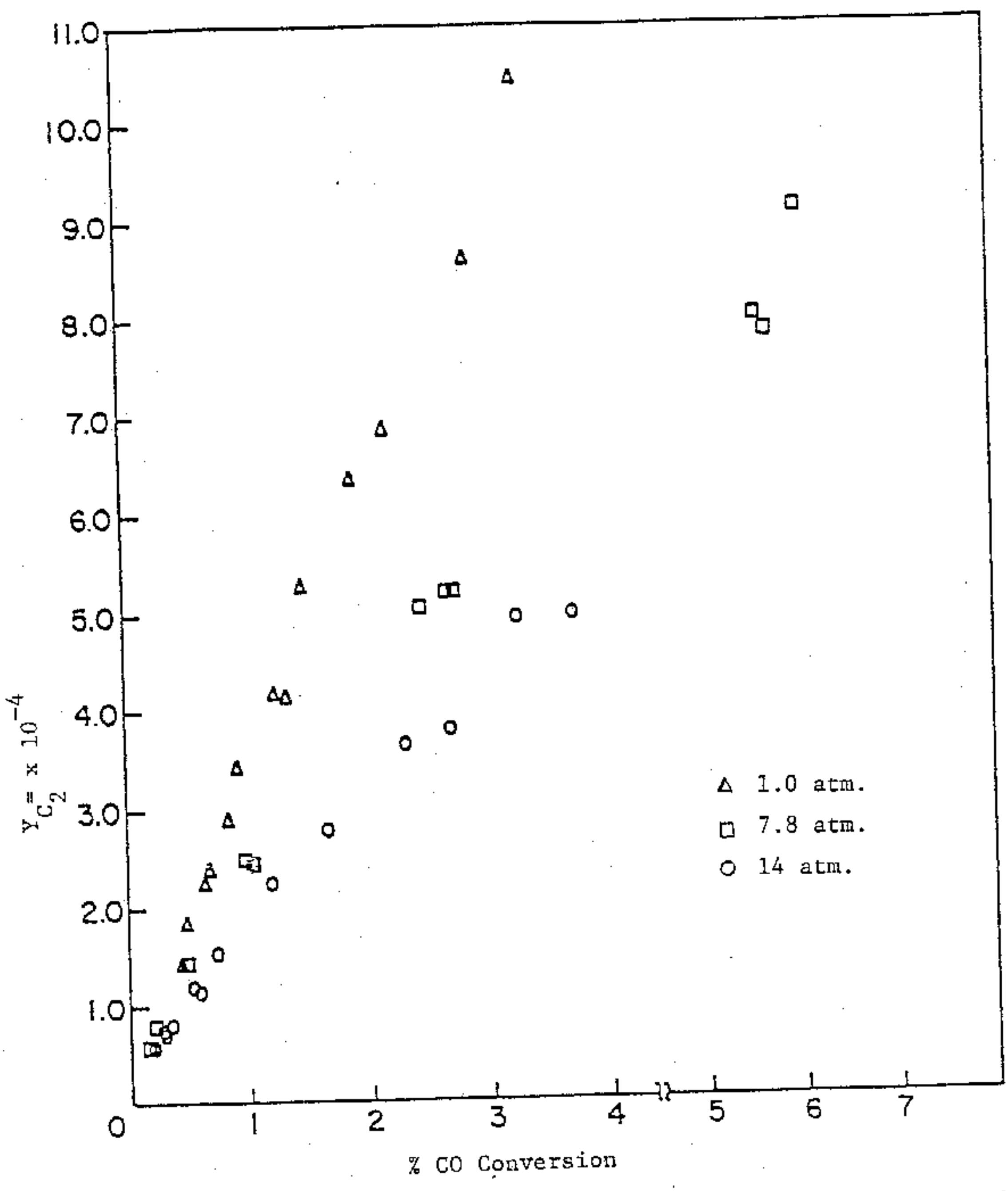

Figure 4.3.22 Ethylene yield versus % CO conversion for the FeCo catalyst at 1, 7.8 and 14 atmospheres in the 1/1 CO/H_2 feed.

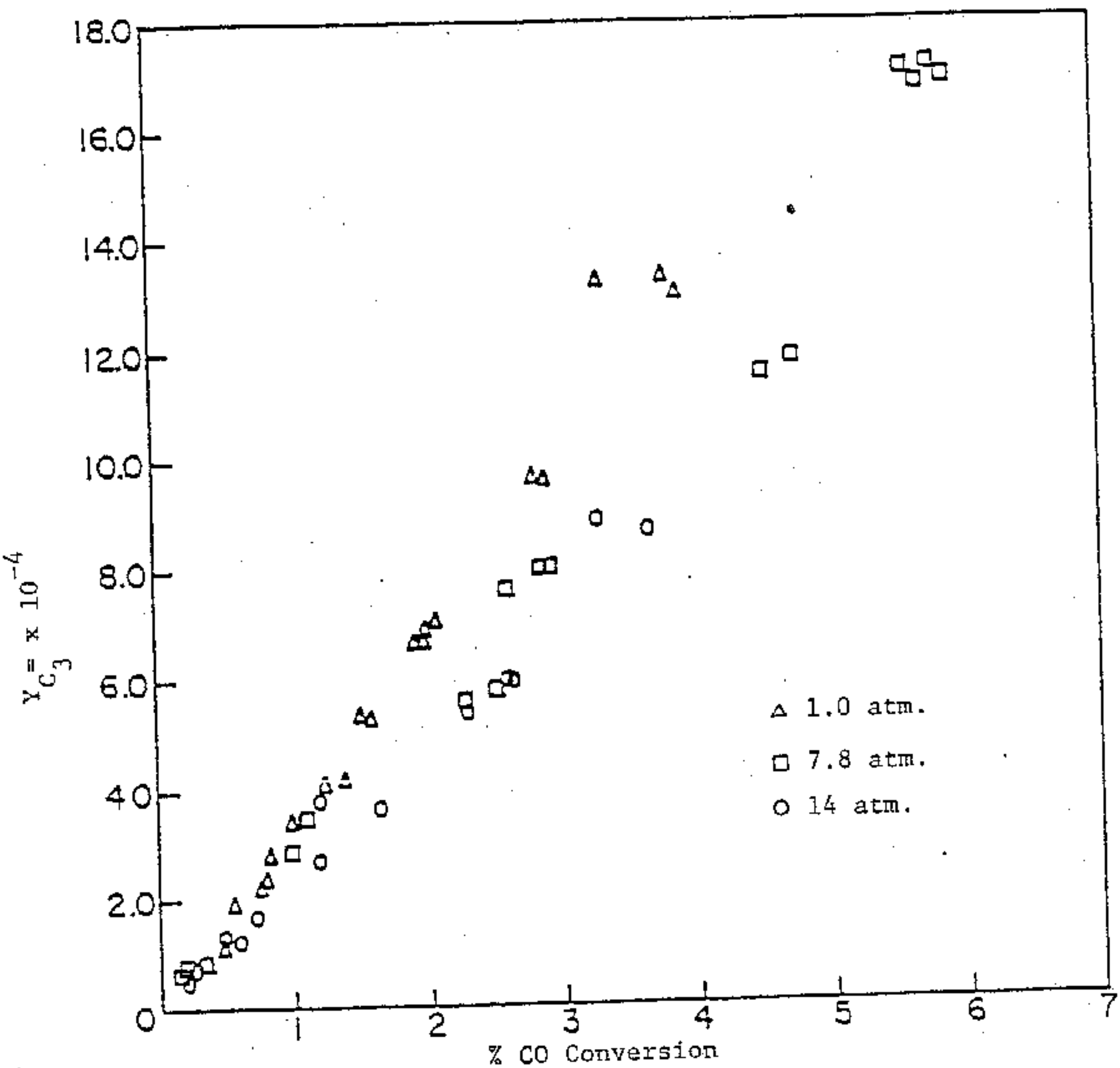

Figure 4.3.23 Propylene yield versus % CO conversion for the FeCo catalyst at 1, 7.8 and 14 atmospheres in the 1/1 CO/H_2 mixture.

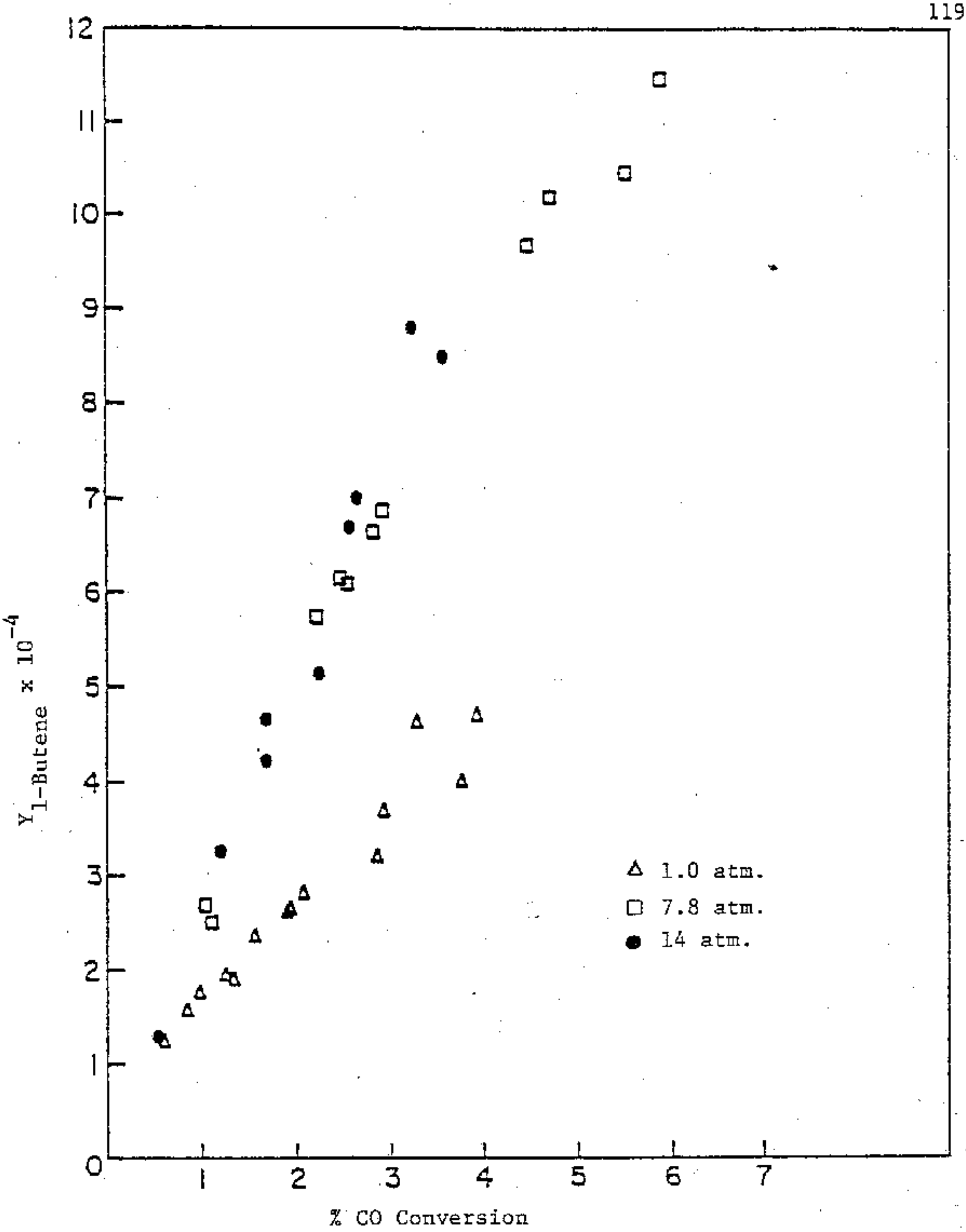

Figure 4.3.24 1-Butene yield versus % CO conversion for the FeCo catalyst at 1, 7.8 and 14 atmospheres in the 1/1 CO/H_2 feed.

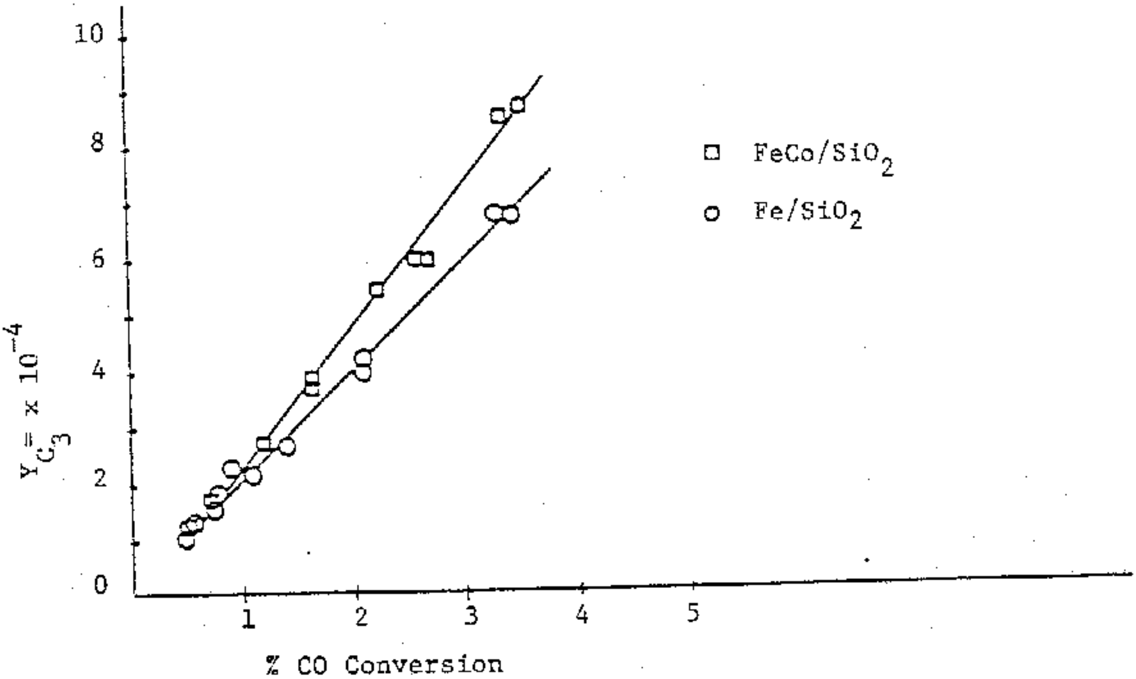

Figure 4.2.25 Propylene yield versus % CO conversion for the Fe and FeCo catalysts at 14 atmospheres in 1/1 CO/H_2 mixture.

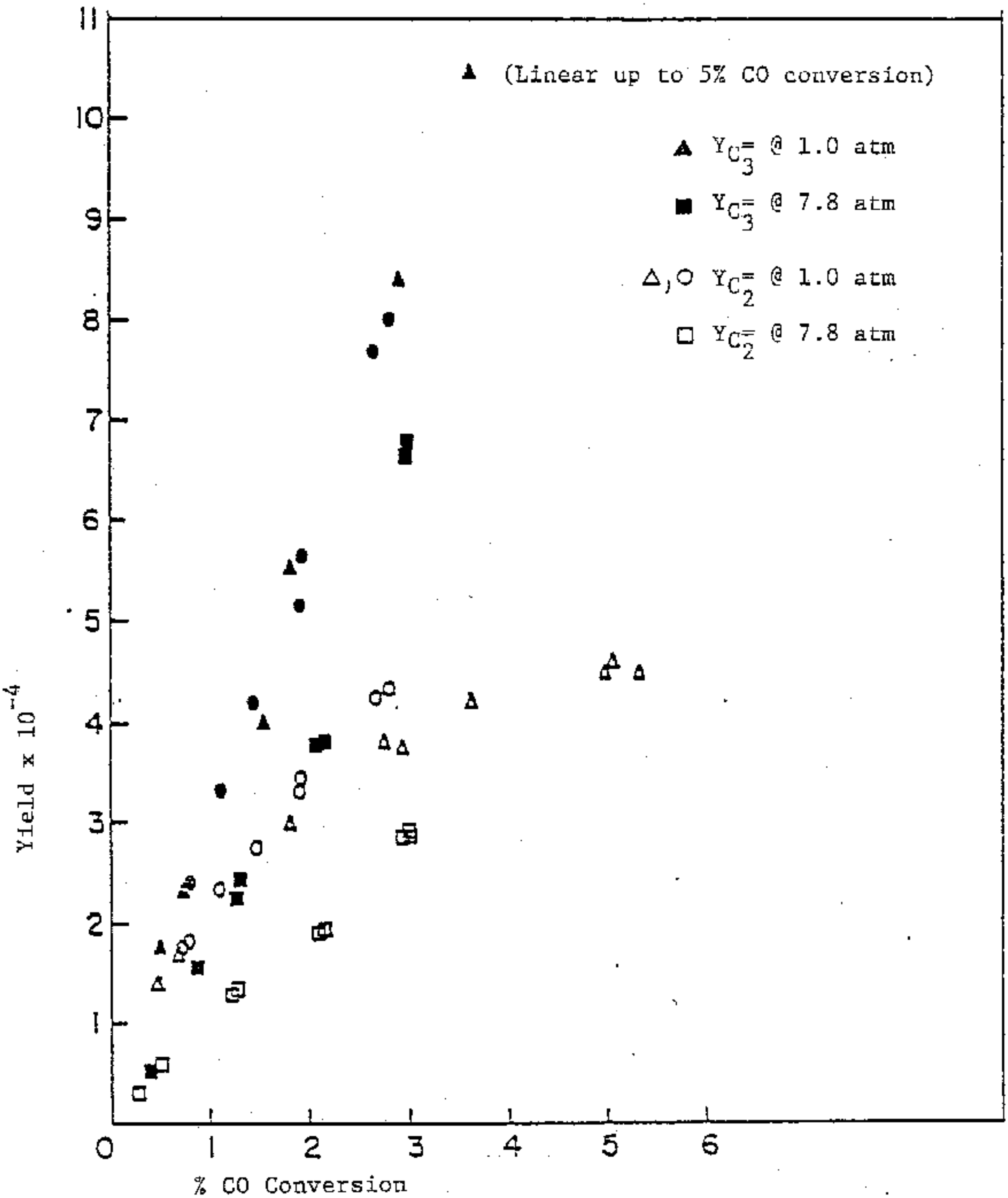

Figure 4.2.26 $Y_{C_2^=}$ and $Y_{C_3^=}$ versus % CO conversion for the Co catalyst at 1 and 7.8 atm. in the 1/1 CO/H_2 mixture.

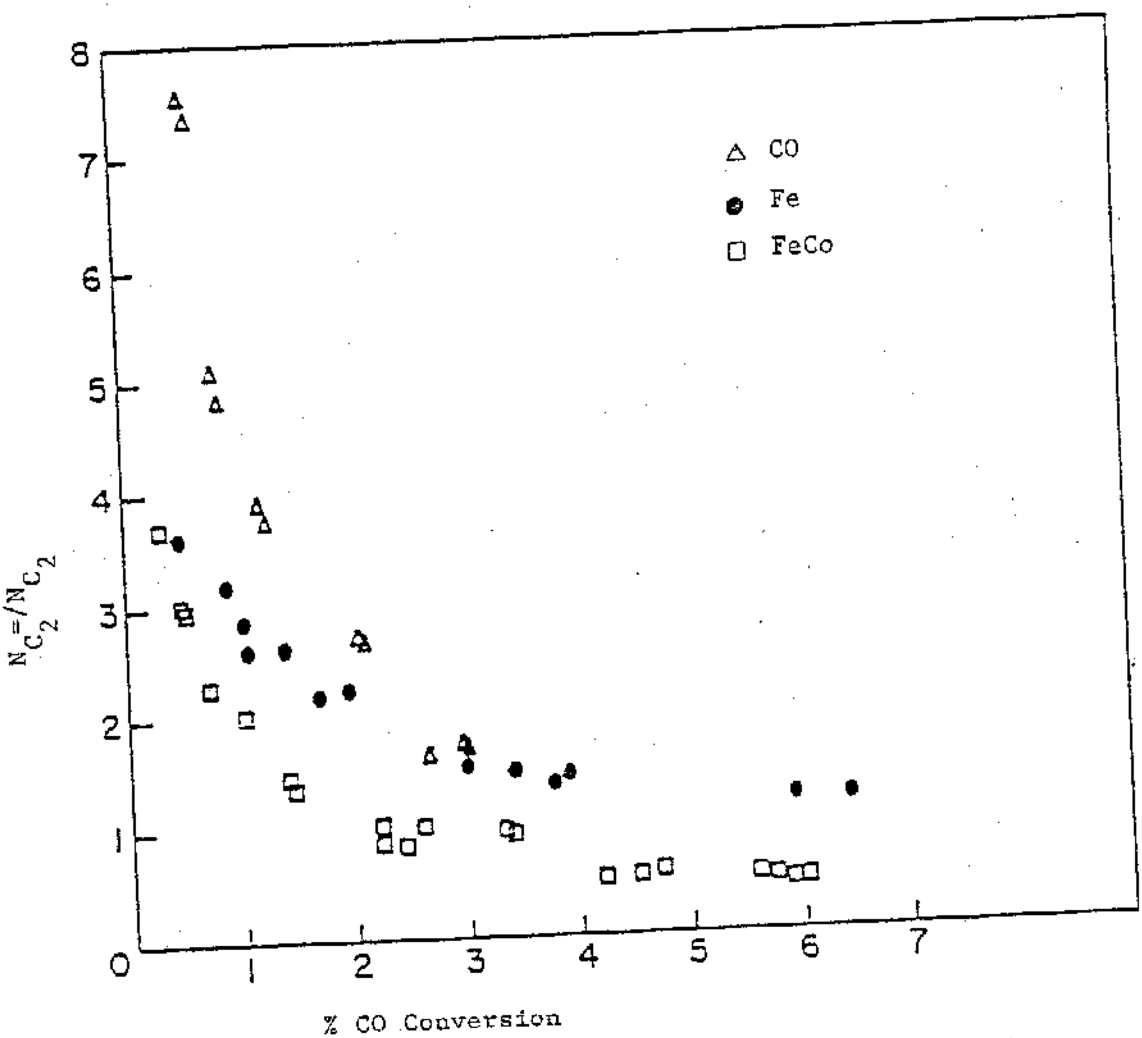

Figure 4.3.27 Ethylene/Ethane yield versus % CO conversion for the Fe, Co, and FeCo catalysts at 7.8 atmospheres in the 1/1 CO/H_2 feed.

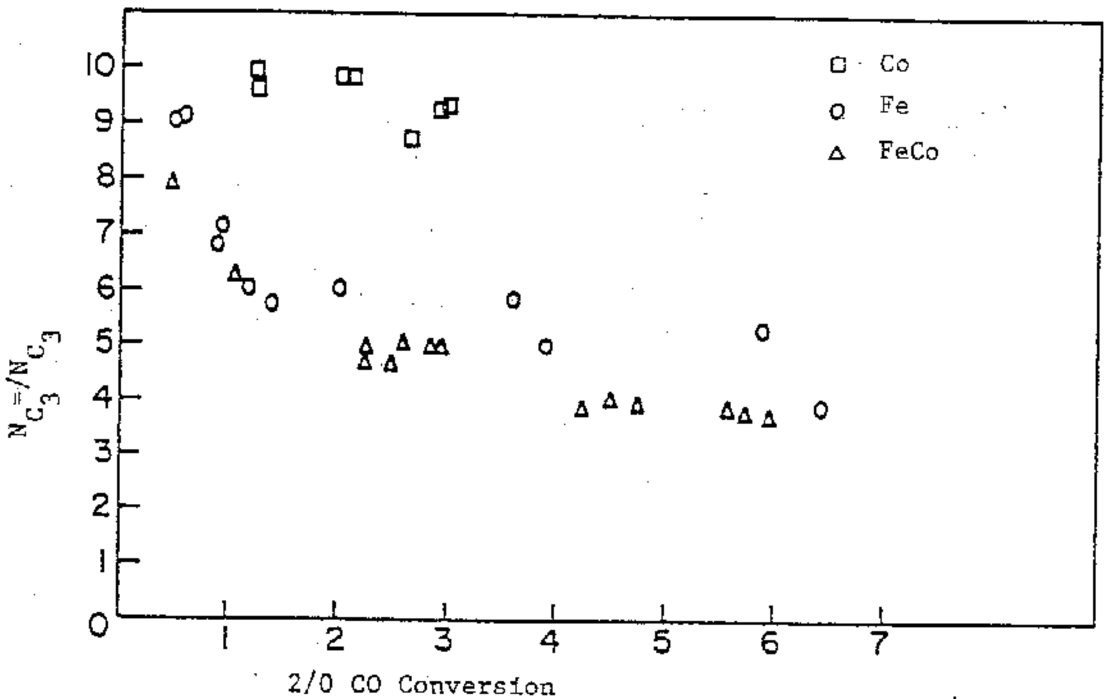

Figure 4.3.28 Propylene/propane selectivity versus CO conversion for the Fe, Co, and FeCo catalysts at 7.8 atmospheres in the 1/1 CO/H_2 mixture.