

CHAPTER V

CONCLUSIONS

In methane total combustion over palladium supported alumina catalyst, the temperature effects on the rate of reaction is in agreement with the Arrhenius equation. The approximate activation energy of reaction is 43,534 cal/g-mol.

The effect of air-fuel ratio depends on the range of concentration studied. In lean methane-air mixture (air-fuel ratios higher than 9.254), all of methane converts to carbon dioxide and water. At air-fuel ratios between 11.40-18.49, the increase in air-fuel ratio decreases the conversion of the reaction and for higher air-fuel ratios between 24.20-94.63, the increase in air-fuel ratio increases the conversion of the reaction. The minimum conversion occurs at an air-fuel ratio around 21, which is close to that at the lower limit of flammability (21.94).

In the fuel-rich mixtures(air-fuel ratios lower than 9.254), the products are not only carbon dioxide and water but also carbon monoxide, hydrogen and small amount of coke formation on the catalyst. The selectivity of carbon dioxide formation decreases when air-fuel ratio decreases between 6.00-8.54. The minimum selectivity occurs around an air-fuel ratio of 5.8 that is close to that at the upper limit of flammability(5.43). This may be due to the reverse water-gas shift reaction. At the lowest air-fuel ratios between 3.27-5.25, the selectivity increases again. Again, it may be possible for the forward water-gas shift reaction to take place, as there are more water in the system, which will eventually increase the selectivity of CO₂ formation.