

CHAPTER VI

CONCLUSIONS AND RECOMMENDATION

Conclusions

1. In the kinetic study, the reaction rate constant based on metal active site is suitable for the reaction which deactivates by coking. The performance of three types of catalysts are $\text{Pt-Sn-K}/\gamma\text{-Al}_2\text{O}_3 > \text{Pt-Sn}/\gamma\text{-Al}_2\text{O}_3 > \text{Pt}/\gamma\text{-Al}_2\text{O}_3$. The frequency factor and activation energy of the $\text{Pt-Sn-K}/\gamma\text{-Al}_2\text{O}_3$ catalyst can be determined as $6.14 \times 10^{-24} \text{ mol}/(\text{site} \cdot \text{s} \cdot \text{Pa})$ and 62.7 kJ/mol , respectively. The formation of coke only blocks part of active surface area but does not change the rest of the active sites involved in the reaction.
2. In the permeation study, the permeation of hydrogen through 77%Pd/23%Ag membrane with $100 \mu\text{m}$ thickness can be described by Sieverts's law, and the permeability coefficient was increased with temperature. The frequency factor and activation energy can be determined as $0.144 \text{ mol}/(\text{s} \cdot \text{m}^2 \cdot \text{Pa}^{0.5})$ and 61.7 kJ/mol , respectively.
3. In the membrane reactor studies, the hydrogen was continuously removed from the reaction zone thereby the performance was superior to the conventional reactors.
 - 3.1. The main factors to enhancing the hydrogen permeation through membrane are high weep gas flow rate and the thin palladium film.
 - 3.2. The radial diffusion effect in the palladium membrane reactor is not significant in the range of this study.
 - 3.3. To obtain the same propane conversion the membrane reactor can be operated with lower operating temperature.

Recommendations

This work studies the dehydrogenation of propane in the palladium membrane reactor by performing experiment and computer simulation. However, the experimental results do not show significant improvement over equilibrium conversion. This is because the membrane is too thick. It is recommended that a new membrane with much thinner palladium film should be employed to emphasize the improvement of reactor performance from the membrane reactor concept. Moreover, since propane dehydrogenation is endothermic reaction, the temperature profiles in the catalyst bed may be different from isothermal operation. Therefore, the further study should be carried.