CHAPTER I

INTRODUCTION

Catalysts are widely usual in petrochemical industries. The synthesis of propylene by dehydrogenation of propane is a reaction that catalysts play an important role in decreasing reaction temperature and increasing product selectivity. Despite the fact that the catalyst has been used, a high reaction temperature is still required to achieve an acceptable conversion. This is because the reaction is an endothermic process. However, this condition also favour the formation of some carbon compounds, commonly called coke, on the catalyst surface, which results in catalyst deactivation. The formation of these carbonaceous compounds, which simultaneously taking place with the propane dehydrogenation reaction, is an undesired reaction. Because the deposit progressively deactivated the catalyst by blocking its active sites(Pieck,C.L., et.al.,1989). The deactivation causes changes in activity, selectivity and stability of the catalysts.

Obviously the arguments as to whether a catalyst should be discarded or regenerated depends to a great extent on economic factors. Chief of these is the cost of the catalyst as compared with the useful catalyst life obtained in the reactor. If the catalyst has a life of several years and is not of the

precious metal type, regeneration may not be worthwhile. All dehydrogenation catalysts, however, are composed of noble metals especially platinum as base metals, regeneration of such catalysts is indispensable.

The main problem in regeneration of coked catalyst particles is the minimization of the temperature rise by exothermic oxidation reaction when the coke is convert into carbondioxide and carbonmonoxide. This is because if the regenerating condition is too mild, the coke may not be completely removed or the regeneration time may be to long. On the contrary, if the regenerating condition is too strong, the catalyst may be irreversibly deactivated by other mechanisms ie. the sintering of metal sites and/or the transformation of the support from a high surface area phase to a low surface area phase. The usual procedure is to admit only a very low concentration of oxygen into the reactor. Main area of catalyst deactivation, extensive studies have been undertaken to determine the optimum conditions for regeneration. However, only a few papers dealing with the evaluation of the kinetic parameters of the burning process of coke deposit on dehydrogenation catalysts are published.

From the burning characteristics of the coke deposit on dehydrogenation catalysts, it has been concluded that the coke can be catagorised into 2 groups, according to their location (Aissa,M.H. (1987), Barbier (1986), Barbier (1987), Carlos (1989), Carlos (1992)) i.e. (1). coke deposit on metal sites and (2). coke deposit on catalyst support. In addition, it is

observed that it is easier to remove the coke on metal sites when compare to the coke deposit on catalyst support.

Because of these reasons, it has been concluded that it is very important to know the rate of coke combustion in order to determine a suitable generating condition.

In the matter, this research is intended to study the modification of the location and composition of coke on catalyst . If we can know them, we can estimate to the rate of coke combustion and take to design a new regenerator.

The objectives of this study are

1. To study the characteristic of the combustion of coke on
   a propane dehydrogenation catalyst.
2. To verify the combustion temperature of reversible coke.
3. To determine the combustion rate of cokes on the
   dehydrogenation catalyst.

The present work is arranged as follows, chapter II presents a literature review of coke burning on catalysts.

The theory of this work, studies deactivation by coking, coke formation on catalysts and combustion of coke on catalysts are presented in chapter III.

In chapter IV, the experimental systems and the operational procedure are described.

The experimental results obtained from a laboratory scale reactor are reported and discussed in chapter V.

Chapter VI gives overall conclusion emerged from this work and presents some recommendations for any future works.

Finally, specification of alumina support, sample of calculations, data of experiment and published paper which has emerged from this study are included in appendix at the end of this thesis.