CHAPTER I
INTRODUCTION

Oxidation of organic vapor in the presence of solid catalysts has gained importance as one of the promising methods for organic synthesis and air pollution control. To develop new transition metal based catalytic materials, knowledge of the reaction is desirable. In the cases of the selective oxidation reactions over metal oxide catalysts the so-called Mars-van Krevelen or redox mechanism has been widely accepted, where the oxidized catalyst surface oxidizes the reactant, and is reoxidized by gas-phase O_2 in a separate step [Mars and van Krevelen (1954)].

Cobalt oxides have been interested materials in the field of heterogeneous catalysis and surface chemistry. Compare with transition metal oxides Co_3O_4 demonstrates the highest catalytic activity for the combustion of organic compounds, CO, and ammonia. Co_3O_4 is more active than $MgCr_2O_4$, CuO, and Mn_3O_4 catalysts for propane oxidation [Finocchio et al. (1997), Baldi et al. (1998)] and cobalt oxide supported on alumina is active for the total oxidation of methane [Garbowski et al. (1990)].

The basic catalyst surface has been claimed to increase the alkene selectivity during the oxidative dehydrogenation of alkanes due to its stability to promote alkene desorption. On supported vanadium or molybdenum oxides, it was shown that incorporating alkaline metals decreased both conversion of propane and the yields of products but increased the selectivity to propene at the expense of the selectivity of the CO_x [Grabowski et al. (1995)].

MgO is a basic support widely used as a support for V_2O_5 catalysts in the oxidative dehydrogenation reactions. It is suggested that the loading of V_2O_5 catalyst on MgO having solid-base properties or the formation of complex metal oxide between V_2O_5 and MgO, reduces the strong oxidation ability of V_2O_5 to attain higher propene selectivity [Chaar et al. (1988)].

Many researchers found that the characteristic of oxide catalysts depend on the nature of support. The suitable support can improve catalytic activity and selectivity of catalyst. For the partial catalysts, MgO is chosen as support for V_2O_5 and manganese oxide catalysts. Because MgO is a basic support which can reduce the strong oxidation ability of V_2O_5 to attain a selective oxidation catalyst.

Cobalt oxide catalyst is another one which has strong oxidation ability. To reduce the oxidation ability of cobalt oxide, a possible method is to incorporate basic support to cobalt oxide in order to reduce the strong oxidation ability of cobalt oxide to attain a selective oxidation catalyst which is active and selective at low temperature.

There are many studies about cobalt oxide and acidic supported cobalt oxide catalysts which are active for the total oxidation of organic compounds. In contrast, the studies on selective oxidation reaction of organic compounds on basic supported cobalt oxide catalysts are scarce.

In the previous studies, there were few studies about cobalt oxide supported on basic oxide. Cobalt oxide supported on magnesium oxide catalyst was used as catalysts for the oxidation of methane to synthesis gas [Santos *et al.* (1996)] and catalytic decomposition of N_2O [Drago *et al.* (1997)].

In this research cobalt oxide support on MgO is used as catalyst for oxidation reaction of propane, 1-propanol, propene, and CO.

In this study the Co-Mg-O catalyst with different cobalt loading have been used to investigate:

1. The oxidation property of Co-Mg-O catalyst for propane, 1-propanol, propene, and CO reactants.
2. The effect of different cobalt loading on the oxidation property of Co-Mg-O catalyst.

This present work is organized as follows;

Chapter II contains a literature reviews of oxidation reaction over some related oxide catalysts.

The theory of this research, studies about the oxidation reaction and its possible mechanism, property of cobalt oxide and MgO catalyst are presented in chapter III.

. Description of experimental systems and the operational procedures are described in chapter IV.

Chapter V reveals the experimental results of the characterization of Co-Mg-O catalysts and the oxidation reaction of propane, 1-propanol, propene, and CO over Co-Mg-O catalysts.

Chapter VI contains the overall conclusion emerged from this research.

Finally, the sample of calculation of catalyst preparation, external and internal diffusion limitations, calibration curve of propane, propene, methane, ethene, 1-propanol, propanal, formaldehyde, CO, and CO_2, data of this experiment and a published paper which has emerged from this study are included in appendices at the end of this thesis.