CHAPTER I
INTRODUCTION

Among all reactions used to convert organic reactant into more useful and valuable products, selective oxidation is the most widely used, especially for the production of bulk organic chemicals. Most of catalysts that used for selective oxidation are supported transition metal oxides.

Supported cobalt oxide catalysts have been interested and widely used for total oxidation reaction of various compounds such as hydrocarbon, diesel soot, carbon monoxide and ammonia because cobalt oxide is more active than other transition metal oxide on this reaction [Finocchio *et al.* (1997) and Baldi *et al.* (1998)].

MgO is a solid of high technical significance and widespread use as a refractory material. Its catalytic interest lies in its essentially basic surface character, which makes it an effective catalyst support. In several previous studies, MgO was widely used as a support for various catalysts such as V_2O_5, Au, and Pt in the oxidation reaction. In the case of V_2O_5 catalyst, it was suggested that there was the formation of complex metal oxide between V_2O_5 and MgO and then the oxidation ability of V_2O_5 is reduced [Charr *et al.* (1988)]. Therefore, MgO is used as a basic support of cobalt oxide catalyst in this study.

Since cobalt oxide has high oxidation ability for oxidation of hydrocarbon, most of products are CO_2 and water, which have low value. Therefore, to attain a new selective oxidation catalyst there was an idea to decrease oxidation ability of cobalt oxide by loading Co_3O_4 on MgO. It was found that Co-Mg-O is the new catalyst applied to use in the oxidative coupling of methane, the catalytic decomposition of N_2O, the oxidation of methane to synthesis gas, selective oxidation of propane, propylene, 1-propanol, and CO [Youngwanishsate (1998)], the selective oxidation of methanol, ethanol, 1-propanol, 2-propanol and 1-butanol [Kittikerdkulchai (1999)], and Co-Mg-O supported on TiO_2 was used as catalyst for the selective oxidation of 1-propanol and 2-propanol [Chaiyasit (2000)].

The suitability of chemical compounds as catalysts for industrial processes is determined mainly by their activity, selectivity and stability which is the ability to retain initial activity and selectivity, over the catalysts' lifetime. Decrement of activity and selectivity might due to catalyst deactivation, which can be divided into 4 categories.

1. Poisoning
2. Fouling
3. Reduction of active surface
4. Loss of active species

The term fouling is generally used to describe a physical blockage such as the deposit of dust or fine powder or carbonaceous deposits.

During the transformation of organic compounds over solid catalysts, there is always formation and retention of heavy side-products, either in the pores or on the outer surface or in both positions. The formation of these non-desorbed products, generally called coke, is the most frequent cause of catalyst deactivation in industrial processes. Deactivation by coke is reversible, coke being generally removed by oxidation. Unfortunately, regeneration is often incomplete owing to various secondary effects under the severe conditions of coke removal such as high temperature.

In this research cobalt-magnesium oxide supported on TiO_2 and cobalt-magnesium oxide supported on Al_2O_3 were used as catalysts for selective oxidation of 1-propanol and 2-propanol.

In this study, Co-Mg-O/TiO_2 and Co-Mg-O/Al_2O_3 catalysts have been used to investigated:

1. The stability of Co-Mg-O/TiO_2 and Co-Mg-O/Al_2O_3 catalysts for oxidation reaction of 1-propanol and 2-propanol at 300°C and 500°C for 48 h.
2. The effect of the different order of cobalt and magnesium loading to the stability of supported cobalt-magnesium oxide catalyst.

This present work is organized as follows:

Chapter II contains literature reviews of cobalt oxide and supported cobalt catalysts on various reactions

The theory of this research, studies about the oxidation reaction and its possible mechanism, reaction of alcohols, properties of cobalt oxide and supports, causes of catalyst deactivation are presented in Chapter III.

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

Chapter V reveals the experimental results of the characterization of Co-Mg-O/TiO_2 and Co-Mg-O/Al_2O_3 catalysts and the oxidation reaction of 1-propanol and 2-propanol over these 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 from area to mole of 1-propanol, 2-propanol, formaldehyde, acetaldehyde, propionaldehyde, methane, ethylene, propylene, and CO_2, catalytic activity of blank test, and data of this experiment which has emerged from this study are included in appendices at the end of this thesis.