CHAPTER I
INTRODUCTION

Selective oxidation reactions catalyzed by heterogeneous catalysts are of great industrial significance, especially for the production of bulk organic chemicals. There are many studies about development of the catalytic activity of catalyst on selective oxidation for more than 30 years. Most of catalysts that used for selective oxidation are supported transition metal oxide.

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)].

Since cobalt oxide has high oxidation ability for oxidation of hydrocarbon, most of products are CO_2 and water, which have low value. Therefore, there is an idea to decrease oxidation ability of cobalt oxide to attain a new selective oxidation catalyst.

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.

There are some researches about cobalt oxide support on magnesium oxide catalyst on various reactions such as the catalytic decomposition of N_2O [Drago *et al.* (1997)], the oxidation of methane to synthesis gas [Santos *et al.* (1996)], and the

oxidative dehydrogenation of propane, propylene, 1-propanol, and CO [Youngwanishsate (1998)].

In this research cobalt oxide support on MgO is used as catalyst for selective oxidation of methanol, ethanol, 1-propanol, 2-propanol, and 1-butanol.

In this study Co/MgO catalyst have been used to investigated:

1. The oxidation property of Co/MgO catalyst for methanol, ethanol, 1-propanol, 2-propanol, and 1-butanol reactants.
2. The influence of other support such as SiO_2 and γ-Al_2O_3 to the oxidation property of supported cobalt oxide catalyst.

This present work is organized as follows:

Chapter II contains literature reviews of Co/MgO catalyst on various reactions.

The theory of this research, studies about the oxidation reaction and its possible mechanism, property of cobalt oxide and supports 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/MgO, Co/SiO_2, and Co/γ-Al_2O_3 catalysts and the oxidation reaction of methanol, ethanol, 1-propanol, 2-propanol, and 1-butanol 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 of methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, formaldehyde, acetaldehyde, propionaldehyde, methane, ethylene, propane, propylene, and CO_2, data of this experiment, and blank test of all reactions which has emerged from this study are included in appendices at the end of this thesis.