



CHAPTER I

INTRODUCTION

1.1 Introduction

Although methane is a main constituent of both natural gas and the associated gas resulting from crude oil production, however, these gases seem to be of little value for use as chemical feedstock. Because of the chemical inactive characteristic of methane it can react only with few oxidants such as oxygen and halogens. In chemical processing aspect, it has only been used largely for the production in synthesis gas via steam reforming reaction. Consequently, the major current application of methane is that as fuel.

Recently, the conversion of methane to more valuable chemical compounds has been investigated extensively. One of the most interesting reactions is the heterogeneous catalytic oxidative coupling of methane to C_2 -hydrocarbons (ethane and ethylene) which is able to proceed in one step process. A variety of catalysts have been reported that have effect on the reaction. However, those catalysts were examined by considering various aspects and conditions. To understand more precisely, a

systematic investigation is necessary. Therefore, in the present study, a number of Periodic elements, such as alkali and transition metals elements were prepared and investigated. The preparation method of investigated catalyst was fixed through out this study by using a conventional impregnation method. The prepared catalyst were divided into three portions, the first one was used for physical characterization. The remaining 2 portions were pretreated separately with oxygen and hydrogen to form, namely, oxidizing and reducing forms respectively.

The study of catalyst performance of the design catalysts, and, various factors were investigated such as Li, Mg, V, Fe and Cu were used for primary compound effect, ZnO, Al₂O₃, SiO₂ and zeolite were used for the study of support effect. The reaction conditions were varied as the following; temperature ranging from 450°C-650°C, pressure of 1 atm to 30 atm and CH₄:O₂ mole ratio ranging of 5:1 to 50:1.

Scanning electron microscope and infrared spectroscopy were used to characterize the morphology and chemical nature of catalysts respectively.

1.2 Objectives

The objectives of this study are the following.

1. To study the effect of various primary compounds such as

Li, Mg, V, Fe, and Cu on the oxidative coupling of methane.

2. To study the effect of various supports such as ZnO, Al_2O_3 , SiO_2 , and zeolite on the catalytic performance of the catalysts.

3. To study the effect of reaction conditions such as temperature, methane to oxygen mole ratio and pressure.

4. To characterize physical properties of the catalysts by using scanning electron microscope and infrared spectroscope.

1.3 Scope of Work

The scope of the present work encompasses the following tasks.

1. Fabricate a tubular high-pressure reactor system (design temperature : 750°C ; design pressure : 70 atm) and construct a furnace for a reactor unit and find out its temperature profile in order to check the uniformity of the axial temperature distribution in the furnace.

2. Study and prepare the catalysts used in this experiments.

3. Standardize the compounds which must be analyzed in the quantity of feed and product to the gas chromatography.

4. Carry out experiments, calculate and discuss the results.

5. Characterize physical properties of the catalysts by using scanning electron microscope and infrared spectroscope.

6. Conclude the results and carry out a thesis.