CHAPTER I
INTRODUCTION

Nowadays, global economic and population growths lead to the expansion of many industries, especially petrochemical industry. Ethylene oxide, epoxyethane, dimethylene oxide, oxacyclopropane, or oxirane (C_2H_4O, EO) is one of important industrial chemicals that is used to produce many useful chemicals. It is a colorless flammable gas with a sweet odor, and miscibility in water. Moreover, it is classified as a carcinogen.

Ethylene oxide can be formed polyethylene glycol or polyethylene oxide, which is very useful in surfactant and cosmetic industries. In addition, ethylene glycol generated from ethylene oxide is commonly used as an automotive coolant. The main usage of ethylene glycol is for the production of polyester polymers. Moreover, ethylene oxide is used in many industries such as for foodstuffs and medical supplies, pharmaceuticals, textiles, and adhesives (Mendes *et al.*, 2007; Watkinson, 2007). The important method to synthesize effectively commercial ethylene oxide from ethylene is the gas-phase partial oxidation of ethylene or ethylene epoxidation with using Ag/(LSA)α-Al_2O_3 catalysts. Nonetheless, this commercial process can give relatively higher ethylene oxide selectivity with a very low yield; a high temperature operation is required for normal operation, leading to both high power consumption and catalyst deactivation. Therefore, a new method with lower energy consumption and higher EO production efficiency is of great interest.

Plasma techniques can be divided into two parts: thermal and non-thermal plasmas. Non-thermal plasma, one kind of electric gas discharges, can initiate several chemical reactions under ambient temperature and atmospheric pressure. We focused on Dielectric Barrier Discharge (DBD) that is one type of non-thermal plasma because it provides high conversion and can generate fairly uniform plasma. For principle of DBD, electrons received energy from applied voltage to overwhelm the potential barrier of metallic electrode surface and directly collided with the gaseous substances to generate new ions and neutral species. These generated dissociated species further reacted with other active and non-active species to yield various products. The examples of chemical synthesis using the non-thermal plasma are oxidations of olefins and aromatics (Suhr *et al.*, 1988; Patiño *et al.*, 1996; Tansuwan, 2007).

In addition, non-thermal plasma technique offers several advantages over than conventional catalytic processes. It can be operated low temperature close to room temperature and slightly higher than atmospheric pressure, leading to lower power consumption. However, this method provides a lower selectivity for ethylene oxide than the catalytic technique (Pietruszka *et al.*, 2004).

For these reasons, in this work, ethylene epoxidation using low-temperature dielectric barrier discharge reactor with two dielectric rough glasses as dielectric material was investigated. The effects of various operating parameters including feed O_2/C_2H_4 molar ratio, applied voltage, input frequency, and ethylene feed position on the ethylene epoxidation activity was examined in order to obtain maximum ethylene oxide production performance.