CHAPTER I
INTRODUCTION

Normally, the types of gas presenting in the natural gas are H_2, N_2, O_2, CH_4 and CO_2, which are independent sources of the synthesis gas production. However, one problem commonly found in the natural gas processing is the pipeline corrosion, which is induced by the acidic gas such as acidic carbon dioxide gas, etc. Moreover, carbon dioxide gas is also the cause of the greenhouse effect.

To reduce the pipeline corrosion and also to produce high–purity energy products, gas separation technique by membrane is the attractive way to separate carbon dioxide gas (longer and slender molecule) from methane (more compact molecule with slightly longer cross-section) in the natural gas processing because it is low energy consumption, simple operation and low maintenance requirement (Şen *et al.*, 2007).

One of the most important elements in the gas separation technique is the membrane. In this study, polybenzoxazine which is a high performance thermosetting resin is selected as the membrane matrix. Additionally, polybenzoxazine exhibits excellent properties such as small shrinkage after curing, low water absorption, good thermal stability and high glass transition temperature (Liu *et al.*, 2004). However, in order to improve the selectivity of a dense membrane in the separation process, zeolite—which can act as a molecular sieve—is added to form a mixed matrix membrane (MMM) or composite membrane to enhance the separation performance, while still maintaining a low cost, simplicity of operation and high processing flexibility.

The schematic drawing of a mixed matrix membrane is shown in Fig. 1.1. The enhanced separation properties are accomplished by adding a dispersed phase to the processable polymer matrix, the net result of which should be an improvement in the separation properties of the overall membrane. While the bulk phase (phase B in Figure 1.1) is typically a polymer or a ceramic support, the dispersed phase (phase A in Figure 1.1) represents molecular sieves, liquids, or liquid–impregnated sieves (Liu *et al.*, 2004).

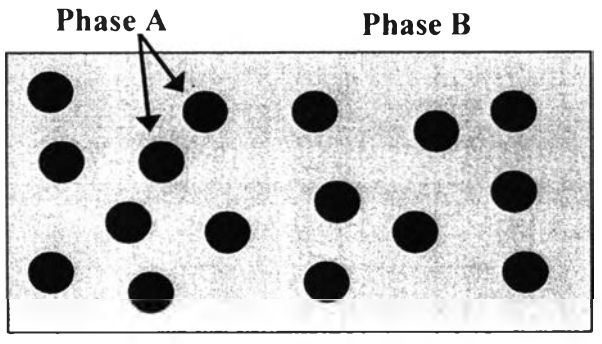

Figure 1.1 Schematic drawing of a mixed matrix membrane – phase A dispersed in phase B matrix.

The purpose of this work is to develop a new MMM by using polybenzoxazine—the new high performance thermosetting resin—as the continuous phase mixed with zeolite for gas separation and to study the ability of this MMM for the separation of carbon dioxide gas from methane.