CHAPTER I
INTRODUCTION

Nowadays, piezoelectric materials have widely used as sensors or transducers in daily life because of their wide bandwidth, high sensitivity, good electromechanical properties, low power requirements, and high generation force. General classes of piezoelectric materials are ceramic and polymer. Ceramics are available in the piezoelectric ceramic commercial such as Lead Zirconate Titanate (PZT). Unfortunately, ceramic is fragile, not flexible and not environmental friendly. Therefore, polymers are more interesting as a new piezoelectric material than ceramic based due to their many advantages, such as large strain, light weight that can be readily manufactured into sheets or complex shapes for specific applications.

Poly(vinylidene fluoride) (PVDF) is the first available piezoelectric polymer film that has the highest piezoelectric properties among all synthetic polymers. If the stretched PVDF film is subjected to a strong electric field for several hours and cooled to room temperature under an electrical field, the film then becomes strongly piezoelectric. This property will occur when the film is mechanically deformed and will generate an electric charge. Conversely, when an external electric field is applied to piezoelectric materials, they mechanically deform or change their physical dimensions. However when PVDF films compared with ceramic materials, PVDF films have a lower dielectric and a lower piezoelectric constant.

Due to the low dielectric and piezoelectric constant when compared with ceramic, many researchers have been studying to improve the electromechanical properties of the PVDF film by first making PVDF-copolymer such as Poly(VDF-co-TrFE) and Poly(VDF-co-TeFE). Secondly, a polymer/ceramic composite is fabricated by adding ceramic into the polymer matrix. Later, electrically-charged polymer foams were discovered, such as cellular PP film and cellular PETP film, so-called ferroelectret which are strongly piezoelectric materials, resulting in a significant change of the dipole moment which leads to strong electrical signals between the film electrodes. Those concepts are very interesting but not many researchers are investigating space-charge in cellular PVDF for improving disadvantage and studying of PVDF film.

The purpose of this work is to investigate a novel concept that induces internal bubbles in PVDF film and observe the changes in dielectric and piezoelectric property. The two main techniques for producing the PVDF porous or microcellular film are; first, "Phase Inversion Technique", which the PVDF solution is immersed into a non-solvent that can form different membranes for example cellular, sponge and spherulite structure, second, "Compression Molding Technique" which using blowing agent to create bubbles inside PVDF films. When bubbles are created inside the PVDF film, the charge will accumulate at the surface boundary of pores or bubbles. When the film is squeezed, the charge inside the bubbles or pores will be separated far apart into the negative and positive charges creating strong dipoles in microstructure of the film. This effect is expected to increase piezoelectric properties of PVDF film. In this study, pores or internal bubbles was porposed to be another candidate to use instead of ceramic filler for improving the piezoelectric properties.