CHAPTER I
INTRODUCTION

Dipole moment of polar polymers arises from the orientation of the dipole in the field direction and results in orientational polarization. However, there is no dipolar alignment in non-polar polymers (Nalwa, H.S., 1995). To create the dipolar orientation in non-polar polymers, the presence of defects such as void is necessary.

In recent years, cellular and porous polymers are of interest by researchers. Therefore, a novel concept of creating internal bubbles is introduced by the charge accumulate in bulk of non-polar polymer (Neugschwandtner, G.S. *et al*., 2001). The voids serve not only to reduce the polymer's mass and hardness, but also to form giant dipoles when charged to opposite polarities on their upper and lower internal surfaces (Gerhard-Multhaupt , R., 2002). Electric charges of both polarities are trapped on the internal void surfaces. The piezoelectric activity arises from the combination of the internal electrical charging (formation of macroscopic dipoles) and the anisotropic (voided) polymer matrix (Wegener, M., 2005). Ferroelectric property was also observed in voided films due to gas breakdown and charge trapping inside the voids (Bauer, S., *et al*., 2002).

Polyethylene (PE), polypropylene (PP) and poly(vinyl chloride) (PVC) are thermoplastics which consumed the world synthetic resin production around 60% (Elias, H.-G., 2003) and their usage continues to grow. Nowadays, considerable attention for electret and piezoelectric applications is focused on thermoplastic polymers such as isotactic polypropylene (i-PP). The low price and easy availability make them more interesting to replace ceramics and ferroelectric polymers such as poly (vinylidene fluoride) or PVDF.

The purpose of this work is to investigate novel techniques that induce dipole of polyethylene (PE), polypropylene (PP) and poly(vinyl chloride) (PVC) films by creating internal voids and observe the changes in dielectric, piezoelectric and ferroelectric properties. Two main techniques used for producing voided films were: first, the “Compression Molding Technique” which using blowing agent to create the voids inside the films. Second, the “Phase Separation Technique”, which the polymer solution was immersed into a non-solvent to form different membranes, To study the effects of void shapes on dipole, the stretching of the films which changes the spherical to ellipsoidal voids was further investigated. This effect is expected to increase dipole in voided films because the opposites charges will separated far apart. The experiment is proposed to be the novel techniques for improving dipole of non-polar polymers.