

## Effect of Carbon Nanotubes Incorporation on Characteristics of Sol-gel Derived PZT Film

Charnwit Ruangchalermwong<sup>1\*</sup> and Supasarote Muensit<sup>1,2</sup>

<sup>1</sup>*Department of Physics, Faculty of Science, Prince of Songkla University, Hatyai, Songkhla 90112, Thailand*

<sup>2</sup>*NANOTECH Center of Excellence at Prince of Songkla University, Hatyai, Songkhla 90112, Thailand*

\*Corresponding author. E-mail: [ruangs\\_c@yahoo.cn](mailto:ruangs_c@yahoo.cn)

### ABSTRACT

*Sol-gel derived lead-zirconate-titanate (PZT) thin films with Zr/Ti ratio of 52/48 homogeneously mixed with multiwalled carbon nanotubes (MWNTs) of different weight concentrations. The mixtures were deposited on platinised silicon substrates. The as-deposited films were investigated using various techniques: X-ray diffraction, scanning electron microscopy, polarization versus electric field and frequency-dependent capacitance. The porous films annealed at 650°C showed perovskite phase with randomly oriented polycrystalline. The surface indicated microcracks in the porous films while the cross sectional views did not show any porous traces. It was found that electrical properties such as remnant polarization and capacitance were degraded in the porous films.*

**Key words:** Sol-gel; PZT; MWNTs; Porous

### INTRODUCTION

Influence of porosity on ferroelectric film has been studied not only for bulk and film PZT but also for other ferroelectric materials (Zeng et al., 2007; Seifert et al., 1999; Suyal et al., 2002). Some researchers (Stancu et al., 2007; Suyal and Setter, 2004) recently reported strong impact of porosity conducted by polymer on dielectric constant of PZT films which were suit for good pyroelectric applications. Furthermore, Shaw et al., (2007) synthesized porous PZT layer by adding starch as volatile phase in graded bimorph/trimorph pyroelectric materials. The MWNTs exhibit dissoluble behavior against organic compounds compared with raw polymer powder and have exact shape. Then, the present study aims to study the influence of porosity on electrical properties of the PZT thin films in which the precursor solution was added by the MWNTs varied from 0.2 to 1.0 wt% and then subsequently burnt out to create porosity. Electrical and microstructure characterizations were carried out and reported.