CHAPTER I
INTRODUCTION

Recently, gas sensitive polymer composites have broadened the application of conductive polymer composites and these gas sensors have already shown their potential application as the sensing element in commercial electronic noses (Burl, 2002). The sensing behavior of these polymer composites can be explained by the mechanism that the conductive networks form by connection of filler particles through out the insulate polymer matrix. Sorption of organic vapors into the polymer provides the swelling of the matrix phase. Leading to the separation of the inter-particle path of filler and cut the conducting circuits (Zhan *et al.*, 2008). As a result, the resistance increases sharply. Previously, the conductive fillers utilized to produce gas sensors have been concentrated on carbon blacks (Iwata *et al.*, 2006, and Li *et al.*, 2007), carbon nanotubes (Zhang *et al.*, 2005) and graphite (Knite, 2007).

Carbon aerogel (CA) is one of the unique carbon materials which have nano size pores with highly cross-linked structure. It has been applied in many applications including waste water treatment (Hrubesh *et al.*, 2001), supercapacitors (Zhu *et al.*, 2006) and advance catalyst supports (Mereno-Castilla *et al.*, 2005) due to their properties of large surface area resulting in high adsorption capacity and their controllable pores size. The crosslink density of organic aerogel is one of the most importance characteristics. Since high crosslink density not only provides high structural stability after solvent is removed but also provides high char yield to construct the CA after pyrolysis (Lorjai *et al.*, 2009).

Polybenzoxazine, as a novel type of phenolic resin has recently been developed. This polymer has many fascinating characteristics such as low water adsorption, dimensional stability, and near-zero shrinkage. Polybenzoxazine can be easily prepared from inexpensive material; phenols, formaldehyde, and primary amine. According to the wide variation of raw materials, they have tremendous molecular-design flexibility. Furthermore, polybenzoxazine can be polymerized without strong acid or base catalysts and without generating by-product and volatile (Agag *et al.*, 2006; Dunker *et al.*, 1995; Ishida *et al.*, 2000). Consequently, polybenzoxaizine is promising for organic and carbon aerogel preparation.

In order to realize the advantages of CA described above, the purpose of this work is to fabricate and characterize the gas sensors made from CA thin film composites and measure its resistivity and gas sensitivity towards organic vapors.