CHAPTER I
INTRODUCTION

It is known that the electrical conductivity of semiconducting metal oxides is varied with the composition of gas atmosphere surrounding. Semiconductor oxide for gas sensor applications have been extensively studied in order to understand and improve their sensing properties to flammable and hazardous gases such as H_2, CO, alcohol, and volatile organic for detection of gas leakage and control of industrial processes. Many attempts have been made for improving the sensing properties i.e., sensitivity, selectivity, and stability of semiconductor-oxide gas sensors in order to fit an increasing need of sensors to work in more complicated systems and under more strict conditions. Tin oxide is one of the most widely used semiconductor as a n-type oxide for gas sensors. It shows very high sensitivity to many reducing gases, such as hydrogen and carbon monoxide. An increase of conductance of tin oxide sensors caused by the surface reactions between surface oxygen species and reducing gases is the most important parameter. The sensitivity can be improved by increasing the surface area contacting with the surrounding gases.

The tin oxide (SnO_2) powders used for gas sensors are usually prepared from precursor hydroxides precipitated by the addition of NH_4OH to a $SnCl_4$ aqueous solution. However, it is not easy to obtain high surface area powders because of high degree of agglomeration and the irregular particle morphology. Therefore, a new preparation method for tin oxide powders is necessary, especially for gas sensor applications. A variety of synthesis methods, such as hydrolysis, sol-gel processing, bulk-precipitation, spray drying, hot spraying, laser vaporization and controlled condensation (LVCC), hydrothermal techniques, and microemulsion (reverse micelles) have been reported (Krathong 2002) attractive. Among these methods, the microemulsion technique is the most interesting because it allows for easy control of particle size. A microemulsion is defined as a thermodynamically stable isotropic dispersion of two immiscible liquids due to surface-active molecules stabilizing the microdomain of both liquids. In water-in-oil microemulsions, the aqueous phase is dispersed as microdroplets (typically 1-50 nm in size) surrounded by a monolayer of surfactant molecules in the continuous hydrocarbon phase, has been used as a constraint microreactor for synthesizing ultrafine particles with narrow size distribution by controlling the growth inside of a water drop.

The previous study on microemulsion system of anionic surfactant (AOT)/n-heptane/NaCl aqueous with varying NaCl concentration for preparation of metal oxide (TiO_2) nanoparticles revealed such an interesting morphology. The uniform size and shape of TiO_2 is obtained by successfully controlling of the NaCl addition. However, the tests on the sensing application indicated that sodium salt appeared as an impurity and interfered stability of sensing signal. Thus, the aim of this work is to use nonionic surfactant microemulsions to prepare metal oxide nanoparticles. SnO_2 was used as a single metal oxide model. Moreover, the effect of nonionic surfactants structure temperature and amount of co-surfactant on size of reverse micelles and morphology of SnO_2 were studied.