CHAPTER I

INTRODUCTION

1.1 Motivation

At present, glass is an important material that is utilized for many purposed such as windowpane, windshields of automobiles and so on. Glass not only increases visibility but prevent such as heat and noise. Accordingly, novel properties of glass have been researched to utilize in various applications which are heat reflective glass, conduction glass and architectural flat tempered safety glass. Moreover, the glass can be provided with hydrophilic property using this advanced technology that is sample processing and low cost.

The hydrophilic property of glass surface refers to a physical property that can transiently bond with water through hydrogen bonding, leading to spreading of water across the surface rather than remaining as droplets. Normally hydrophilic property could be achieved after UV irradiation to substrate surface coated with some specific semiconductor. This property could physically be indicated by water contact angle. A surface with water contact angle lower than 10° which is classified as highly hydrophilic surface while a highly hydrophobic surface will show water contact angle higher than 150° (Sun, Nakajima, Fujishima et al., 2001).

Zinc Oxide (ZnO) is of great interest due to its unique optical, electrical and photo-catalyst properties (Berber et al., 2005). ZnO thin film can be applied to coat on glass or plastic substrate with excellent transparency, which will not obstruct the substrate optical visibility, and can provide photoinduced hydrophilic function. Sol-gel method is widely employed for preparing ZnO because of its simplicity, safety and low cost (Maiti et al., 2007). Moreover, incorporation of dip coating method could simply provide a smooth thin film of ZnO on substrate with large area. Sun, Nakajima, Watanabe et al. (2001) reported that UV irradiation can generate electron-hole pairs on substrate surface coated with ZnO and leads to hydrophilic property due to some of the holes reacting with lattice oxygen to produce surface oxygen

vacancies. However, there is a remaining issue that preferential adsorption of water on the coated surface cannot last long and reversibly turns to its initial condition after storage in the dark. However, there has been little investigation of preparing transparent of ZnO thin films using sol-gel dip coating method. Especially, improve photoinduced hydrophilic property of ZnO thin films.

The main purpose of this research was to investigate the photoinduced hydrophilic property of glass substrate coated with ZnO thin film which was prepared by sol-gel process incorporating with dip coating technique. The effect of solvents and preparation condition thin film (calcination temperature, withdrawal speed and precursor concentration) on the transmittance of the ZnO thin film was consequently investigated for finding systematic means to improve preparation of highly hydrophilic coated glass substrate.

1.2 Objectives

The objective of this thesis is to investigate preparing condition for ZnO thin films on glass substrate by sol-gel and dip coating method and then examine photoinduced hydrophilic property of the coated glass substrate.

1.3 Scope of research works

1. Determine the optimal preparation of ZnO thin films with variation of the following parameters:
    1.1 Calcined at temperatures: 300, 400, 500°C
    1.2 Withdrawal speeds: 1.0, 1.5, 3.0, 6.0, 9.0 cm/min
    1.3 Precursor concentrations: 0.10, 0.25, 0.50, 0.75 M
2. Determine the water contact angle on ZnO coated glass substrate
3. Determine the effect of UV irradiation time
4. Characterization of ZnO thin films using SEM (Scanning Electron Microscopy), EDX (Energy dispersive spectrometer X-ray), AFM (Atomic Force Microscopy), UV-Vis spectrophotometer, Surface profiler and Contact angle measurement.

1.4 Expected benefits

1. Gain knowledge of the preparing conditions for ZnO thin films using sol-gel dip coating method on the improved photoinduced hydrophilic surface.

2. Understand the effect of solvents, preparation condition on thin film properties and number of layers on thin film improved photoinduced hydrophilic property.