

## CHAPTER I

### INTRODUCTION

#### 1.1 Background

Plastics have become important optical materials because they are light in weight, can be mass produced and cheaper than glasses. Many transparent polymeric materials such as bisphenol-A polycarbonate (bis-A PC), diallyl diglycol carbonate (CR-39) and poly(methyl methacrylate) (PMMA) have excellent optical clarity and lower density than inorganic glasses and can be utilized to make windows, lenses, or other optical devices. Among the plastics, PMMA and polycarbonate (PC) are the well known for making film or sheet of excellent optical properties. However while transparent polymer materials have excellent optical transparency and many beneficial mechanical properties, they show poor scratch resistance which limits their applications. To solve these problems, many kinds of hard coating agents such as melamine, acrylic and urethane resin based hard coating agents were developed [1-4].

The application of surface hardening coating onto plastics is aimed at improving surface hardness and scratch/abrasion resistance. Surface coating for transparent plastics should be clear and has refractive index near these plastics. Among these coating materials, organic-inorganic hybrid composites have created very effective hard coating agents including advantages of both organic and inorganic materials. These are based on the use of metal alkoxide and organosiloxane by the sol-gel method. The sol-gel method is a novel procedure among solution reactions, which is based on the preparation of macromolecular network through the typical hydrolysis of alkoxide groups and the condensation reaction. Then, sol-gel method is one of the effective methods for the coating of colloidal silica at relatively low temperature on various organic polymer substrates [5-6].

The precursor material, silatrane, was proposed to be transparent coating instead of commercial colloidal silica solution. Because silatrane which is alkoxide precursor has ability to hydrolyze and condense via sol-gel process so it challenges us to find the best condition of coating solution.

### **1.2 Objectives of the research work**

1. Prepare the coating material based on organic/inorganic composites via sol-gel process of silatrane.
2. Test the properties of film including scratch resistance, adhesion, and thermal analysis.

### **1.3 Scopes of the research work**

The development of hybrid materials based on organic/inorganic composite is particularly interesting for coating technologist. In this work, silatrane solution was mixed with 3-glycidoxypropyl-trimethoxysilane (GPTS), which was hydrolysed and condensed with the silanol group on the silica particles. Coating films were prepared by depositing these solutions on poly(methyl methacrylate), PMMA, substrates and then dried and cured. After curing, the scratch resistance was measured and compared with an uncoated substrate. To improve the adhesion of the substrates with the coating solution, plasma etching was introduced to the substrates without primer.

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