CHAPTER I
INTRODUCTION

In recent years, artificial marble made of inorganic particle filled polymer has received much attention since it can overcome the weak points of marble stone such as; weight, color, shape, and price. Many studies have been conducted for the development of the material in order to achieve desirable physical properties including the appearance to resemble the natural one. Unsaturated polyester, methacrylate resin, and other highly transparent polymers are shown to be applicable; however, the physical properties are still undesirable. One of the approach to improve the physical and mechanical properties of these polymers is to add fillers. Inorganic fillers such as aluminium hydroxide, magnesium hydroxide, silica, calcium carbonate, calcium silicate, kaolin, etc., have been extensively studied (Ishida and Miller, 1984-89; Porro and Pattacini, 1992; Garbassi et al., 1987). Among those, silica shows desirable properties owing to its fine particle size for homogeneous dispersion, the close refractive index to polymer, the stability in the composite, and the reactive surface for direct chemical reaction onto polymer chain. Plueddemann reported wide variety of the application of silane coupling agents in various polymer systems (Plueddemann, 1982). Ishida et al. extensively studied the adsorption and chemical reactions of silane coupling agents on the silica surface (Ishida et al., 1990-1991).

For the past decades, many studies on PMMA/Silica system received attention for its possibility to be an artificial marble. Most researches were performed on precipitated silica and sand silica while less of studies were concerned with fumed silica. Precipitated silica is known for the high internal and external surface area comparing to fumed silica which has mainly the

external surface area. Thus, precipitated silica are found to be limited for reinforcing level in the composite material owing to its significant internal surface area which is inaccessible to the large molecules such as resin or rubber and thus can be excluded from reinforcement. Wason concluded that the degree of reinforcing is related to the external surface area which is directly related to the type of silica (Wason, 1987).

This study is focused on the fumed silica and to study the molecular correlation of the silica and polymethylmethacrylate (PMMA) system via integral blend technique. Here, γ-methacryloxypropyltrimethoxysilane (γ-MPS) is expected to perform not only as a coupling agent but also the interpenetrating network with PMMA owing to its methacrylate end group. The treated fumed silica is studied at the molecular level in terms of physisorbed silane and chemisorbed silane by SEC and DRIFT techniques, respectively. The treated silica and PMMA with the interpenetrating network is also studied for the rheological property to evaluate the physical property of the artificial marble.