CHAPTER I
INTRODUCTION

The synthesis of silica-based mesostructured materials using supramolecular assemblies of surfactant molecules to template the condensation of inorganic species has attracted considerable interest due to the potential in the fabrication of organic/inorganic nanocomposites. Although the exact mechanism is still controversial, this technique holds great promise as a synthetic scheme to produce nanostructured materials with the unique combinations of properties that cannot be achieved by other materials. The preparation, characterization, and applications of organic/inorganic hybrid materials have become a fast expanding area of research. The major driving forces behind the intense activities in this area are the new and different properties of the nanocomposites which the traditional macroscale composites and conventional materials do not have. For any of these applications to be realized, however, what is required is a method by which these mesostructured materials can be formed into controlled shapes and pattern rather than the microscopic particulates.

Recently, Saphanuchart (2001) has synthesized ultra thin silica films via admicellar polymerization. This technique has been proven to be a versatile, flexible and low-cost process for the ultra thin film formation. In his study, the utilization of atomic force microscopy (AFM) was used to examine the admicellar polymerization of tetra-n-butoxysilane (TBOS) adsolubilized in cetyltrimethylammonium bromide (C_{16}TAB) admicelles to form ultra-thin silica films on freshly cleaved mica surfaces in aqueous solution. The TBOS reaction on mica was examined both with and without the presence of surfactant and in both aqueous and air conditions. System variables included TBOS feed concentration and reaction time. It was shown that under aqueous conditions and in the presence of adsorbed C_{16}TAB the silica formed fibrous, discrete droplets, with flat-layered aggregates observed as the TBOS concentration increased. Furthermore, reaction times of 24 hours or longer were necessary to obtain a stable silica film.

In this study, self-assemblies through the surfactant template technique were used in conjunction with a sol-gel method to achieve nanostructure of

polystyrene/silica composite material. Sol-gel polymerization of inorganic species enables the introduction of organic elements into inorganic materials without deteriorating their functionality. Nonionic surfactant was used to form the self-assembled surfactant template on mica and the reactants included tetraethyl orthosilicate (TEOS) as an inorganic monomer, styrene as an organic monomer, 2, 2' - azobisisobutyronitrile (AIBN) as an initiator in an aqueous solution. This research focused on the formation and characterization of the adsorbed layer of polystyrene/silica composite material on freshly cleaved mica.