CHAPTER I
INTRODUCTION

The formation of surfactant micelles, solubilization of molecules in surfactant micelles and subsequent reactions in these surfactant micelles have been known for many years (emulsion and miniemulsion polymerization). The relatively new concept of surfactant aggregates adsorbed on solid surfaces (admicelles) showing the ability to solubilize molecules (adsolubilization) and of using this for surface templating came together in the mid-1980's. The term admicellar polymerization has been coined for this process. Admicellar polymerization (AP) has opened up an entirely new area of study in which its fundamentals and possible applications have been and continue to be investigated. AP has proven applications for interfacial adhesion improvement in polymer-matrix composites, modification of surface wetting behaviour, coefficient of friction and conductivity enhancement in conductive composites and several other potentially important commercial applications.

Modification of inorganic surfaces by organic polymers via AP is one of the key applications of this new phenomena and most of the research to date has been concerned with surfactant adsorption, monomer adsolubilization and the important reaction in variables of substrates, surfactants, adsolubilizates, and reaction time.

In 1994, O'Haver studied the modification of precipitated amorphous silica with a polystyrene thin film using AP with CTAB surfactant and AIBN initiator. Due to the porous nature of the substrate, only 25% of the polystyrene could be extracted, making definitive statements about the nature of the polymer formed impossible. They also found that water soluble initiators produced poorer reinforcing fillers than did the water insoluble ones under otherwise constant conditions. As variations in the polymer film have significant impact on rubber compound properties, a better understanding of the polymer formed is needed.

Almost all admicellar polymerization studies to date have used a typical free radical polymerization. Thus, work is needed to examine other types of controlled free radical polymerization processes. Additionally, the studies to date have examined only homopolymers formed on nonporous silica. Thus, different polymers

and substrates, along with different kinds of surfactants and initiators need to be examined.

The present research examines the modification of fumed, nonporous silica (Aerosil®OX50) with polystyrene using CTAB cationic surfactant and water-soluble initiator (VA-044) in AP. In addition, the application of controlled RAFT polymerization into admicellar polymerization will also be studied by using RAFT agent cumyl dithiobenzoate (CDB) together with both AIBN and VA-044. Extracted polystyrene were characterized by TGA, FTIR, AFM and GPC. The polystyrene formation on the silica surface and thickness were studied by using AFM.