

## CHAPTER I

### INTRODUCTION

Surfactant adsorption on solids is critical to the development of a new process for engineers. This process is called admicellar polymerization. It has been successfully used to control the adhesion between reinforcers and polymers in polymer composites, to produce corrosion barriers and to create self-lubricating surfaces. The first step in the process is formation of an adsorbed surfactant layer.

To achieve a significant adsorptive capacity, an adsorbent must have a high specific surface area, which implies a highly porous structure with very small micropores. Microporous and mesoporous inorganic solids (with pore diameters of  $< 20 \text{ \AA}$  and  $\sim 20\text{-}500 \text{ \AA}$  respectively) have found great utility as catalysts and sorption media because of their large internal surface areas (Kresge et al., 1992).

Considerable synthesis effort has been devoted to develop frameworks with pore diameters within the mesoporous range; the largest materials synthesized are the phosphate-based AlPO-8 (14-membered ring) (Dessau et al., 1992), VPI-5 (18-membered ring) (Davis et al., 1989) and cloverite (20 membered ring) (Patarin et al., 1993), which have pore diameter within the 0.8-1.3 nm range. Cacoenite, a natural ferroaluminophosphate, has been structurally characterized as having 1.4-nm channels that approach to the mesoporous size range (Moore and Shen, 1983).

A new family of mesoporous molecular sieves designated M41S has been discovered by the Mobil corporation researchers. Members of this family of materials, MCM-41 or Mobil Composition of Matter number 41, were first

observed in electron micrographs of the products from hydrothermal reactions of aluminosilicate gels in the presence of quaternary ammonium surfactants (Kresge et al., 1992). MCM-41 possesses a hexagonal array of uniform mesopores varying from approximately 15 Å to greater than 100 Å in size (Beck et al., 1992). The pore diameter of MCM-41 can be varied by changing the alkyl chain length of the cationic surfactants used in the synthesis procedure and reaction conditions. The formation of these materials takes place by means of a liquid-crystal 'templating' mechanism, in which the silicate material forms inorganic walls between ordered surfactant micelles (Kresge et al., 1992). The larger pore materials typically have surface area above 700 m<sup>2</sup>/g (Beck et al., 1992). It is interesting to investigate the adsorption of this kind of solid which has narrow pore size distribution and high surface area that has a potential in size-specific separations, shape-selective catalysis and as an ordered storage media.