CHAPTER I
INTRODUCTION

Organometallic compounds are of interest, since they combine the thermal stability of inorganic materials, and the elasticity and solubility of organic polymer. Many difficulties that occur in pure organic and inorganic polymers may be avoided. From their chemical composition and polymeric state, organometallic polymers may be processed by sol-gel technique to form various preceramic shapes and structures that can not be achieved by melt processing since they can be processed at temperature much lower than T_g of glass, resulting in low nucleation, crystallization and also low energy consumption. Such preceramic polymers can be used to produce ceramic fibers, ultrafine ceramic powders, thin film, high strength layer structure, light weight composites, and the complex shapes which permit exceptional control of particle size distribution, phase, chemical purity, and microstructure. In addition, the organometallic compounds can also be used for ion conduction and liquid crystal. Many organometallic compounds produced from silicon-based chemicals are used in a wide variety of applications, such as in biocides, stain-and dirt-resistant polymers for carpets, advanced ceramics for aerospace application and electronic components.

Silica, SiO_2, is the most common material found in nature. Due to the widespread availability (28% by weight of the earth's crust) and its extremely low cost, SiO_2 is the ideal starting material for the manufacturing of silicon-based chemicals. However, the primary problem with developing any large scale industrial process based on SiO_2 is the high bond strength between Si-O [128 kcal (535 kJ)/mol]. This results in the low reactivity and the difficulty to manipulate chemically. As there are no naturally occurring organosilicon compounds, they have to be synthesized from SiO_2. The primary silicon-

based feedstock chemicals have thus high relative cost and low environmental stability. High reactivity is particularly problematic in chemical processing. These problems have been solved by modifying the other precursors to reduce hydrolytic reactivity.

Silatrane complexes are one of a family of organosilicon compounds, these compounds are derived from trialkanolamine such as triethanolamine, triisopropanolamine. They have silicon-nitrogen coordination in the structure. These are hydrolytically stable and have unique physical properties. They can be stable in air (moisture) for periods of up to several weeks in their bulk forms. With these reasons the silatrane complexes should be appropriate to be used as ceramic precursors in ceramic or glass processing by sol-gel technique.