CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Nowadays, the defects and losses that cause by atmospheric corrosion always are topics of conference and discussion. Atmospheric corrosion of metal is most commonly observed phenomena in our life. However, the mechanism of atmospheric corrosion of metal has not been clarified because of the difficulty in experimental work.

From the standpoint of economics, safety, and aesthetics, the importance atmospheric corrosion and its control is well recognized. More structure and material are exposed to the atmosphere than to any other environment. It is not surprising, therefore, that a vast body of exists on the performance of materials in the atmosphere and the characterization of such environments. Society interests in the performance of material in the atmosphere were active well before the formation of committee G-1 on corrosion of metal in 1964. The International Organization standardization (ISO) has also been very active in the development of standards for atmospherics testing methods and classification of atmospheres. It seemed a natural follow-up for subcommittee G 01-04 to organize another symposium on atmospheric corrosion, held in November 1993 in Dallas, Texas.

Atmospheric corrosion is the interaction of any material, commonly a metal, with the surrounding atmospheric environment. A well-known example is the rust formation on cars and other vehicles, but also electronic devices, construction materials, our cultural heritage and military equipment, to mention a few examples, are subjected to atmospheric corrosion. Additionally, this kind of corrosion is important to many
naturally occurring processes. Due to the massive economical impact corrosion has on society, a good knowledge of the fundamental processes involved is essential in the search for new preventative measures. Since atmospheric corrosion involves many physical and chemical processes, it requires a good knowledge in several scientific areas, and can thus be considered a truly interdisciplinary field.

The corrosion of a metal, and its transformation to the mineral it was extracted from, has been known for a long time, but it was not until the 1920’s that scientific investigations of corrosion phenomena commenced. This new work was performed by Vernon, who examined the corrosion products formed upon exposure of a metal surface to corrosive gases, such as carbon dioxide (CO$_2$) and sulfur dioxide (SO$_2$)(Vernon, 1923,1927). The researcher studied the influence of relative humidity on the corrosion rate, and realized the importance of water in atmospheric corrosion. During the following decades, the central role of electrochemical reactions was discovered. In the 1960’s, instruments capable of analyzing the chemical composition of the corroded surface started to emerge, and X-ray photoelectron spectroscopy (XPS), and Auger electron spectroscopy (AES) became work-horses as surface analytical tools. Year by year, the technology to investigate the corrosion have been developed in order to analyses corrosion propagations and find the ways to prevent it.

1.2 COST OF ATMOSPHERIC CORROSION

Atmospheric corrosion may cause serious damage to metallic structures and equipments. The effect is so serious that the annual cost of atmospheric corrosion is approximately half the total annual cost of all types of corrosion of metals (W. Ke, 2003). It has been reported that more than half of the national cost of corrosion, which has been estimated at close to 4% of a nation’s gross domestic product, is a result of atmospheric corrosion (J. H. Payer, 1980). As another example, around 20% of failures of aircraft electronics are thought to be due to corrosion-related causes (B. Dobbs and G. Slenski, 1984). It is difficult to estimate the cost of direct or indirect consequences caused by atmospheric corrosion on materials exposed in our environments (C. Leygraf and T. E. Graedel, 2000). It has become evident that acid deposition through rain, snow, fog, or dew has resulted in substantial deterioration of artistic and historic objects,
including old buildings and structures of historic value, statues, monuments and other cultural resources.

1.3 PROBLEM STATEMENT

Atmospheres are often classified as being rural, industrial or marine in nature. Two decidedly rural environments can differ widely in average yearly temperature and rainfall patterns, mean temperature, and perhaps acid rain, can make extrapolations from past behavior less reliable.

The corrosion of metal in the atmosphere and in many aqueous environments is best understood from a film formation and brake down standpoint. It is an inescapable fact that iron in the presence of oxygen and water is thermodynamically unstable with respect to its oxides. Because atmospheric corrosion is an electrolytic process, the presence of an electrolyte is required. This should not be taken to mean that the metal surface must be awash in water; a very thin adsorbed film of water is all that is required.

During the actual exposure, the metal spends some portion of the time awash with water because of rain or splashing and a portion of the time covered with a thin adsorbed water film. The portion of time spent covered with the thin water film depends quite strongly on relative humidity at the exposure site. This fact has led many corrosion scientists to investigate the influence of the time of wetness on the corrosion rate.

Atmospheric corrosion recovers the corrosion that happen in many places such as under sea water, indoor and outdoor. Different environment have different surrounding compositions and parameter such as pH. Therefore, different environment and types of material will give the variation corrosion rate and types that will discuss in this thesis.