# Investigation in Deterioration of Automobile Parts due to Atmospheric Corrosion

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*Abstract*— In daily life, we are using automobiles for different purposes at different seasons at different climatic conditions. So the different environment conditions affect our automobile painted parts and corrosion happens in every part by atmospheric condition. The different environment conditions of atmosphere like humidity, temperature, pollution, air, water, carbon dioxide, acid rain, etc affect automobile parts. From the above mentioned factors any one of the following will definitely attack automobile parts. So there is need to give the resistance to corrosion of paint to prevent it from atmospheric corrosion. In these studies we have taken the number plate as a sample part which is made up mild steel to obtain required coating of paint to prevent it from the different atmospheric conditions. Mild steel is chosen because of its strength, machinability, elasticity, ductility material. So investigation is carried out in the mild steel automobile parts by spraying salt solutions by using the fabricated salt spray testing machine. From continuous spraying of salt solutions mild steel automobile parts will tend to loss some metal due to corrosion. So due to weight loss, the strength of the parts may decrease. By this weight loss method it is analyze, that the part was corroded by any one of the above mentioned factors. So from this study it is studied that the automobile coated parts affected by atmospheric corrosion is analyzed by these investigation at different form of atmospheric conditions.

*Index Terms*--- salt spray testing machine, atmospheric corrosion, automobile parts, mild steel.

## I. INTRODUCTION

Atmospheric corrosion is most probably common form of corrosion and these form occurs by corrosion or degradation due to air and its pollutants . Therefore, it is important to know the specific corrosion rate and coating thickness in a given application environment in order to affectively use metals in outdoor structures. A common method for estimating the life of metals has been the use of various types of metals and alloys for the different types of atmospheres. These differentiated recognition made different atmosphere of corrosion. The major types of atmospheres for corrosions are rural, urban, industrial, marine, or a combination of these. There are many researchers had opted out the corrosion rates of various metals at different atmospheres .These studies were conducted to evaluate the relative corrosion resistance of various metals at different environmental conditions. A metal resisting in one atmosphere may lack in effective resistance performance of metals changes in other atmospheric conditions. In general, the properties of the corrosion product are often the determining factors in the atmospheric corrosion behaviour of metals. The metals may be corroded in between immersed corrosion and dry oxidation, whether metals may be exposed to damp atmospheres or may be subjected to the full force of the weather. It is usually happened while packaging and storage, painting and while preparing for paints, and the effects of climate and air purity. These corrosion mostly in iron and steel and other metals are slightly. Metals exposed to normal atmospheric may corrode rapidly than the metals exposed to rain. In normal atmospheres, the developing oxide film usually protects the underlying metal and giving rise to a logarithmic or square-root time law. In uncontrolled corrosion will form constant at particular thickness and fall of when it reached certain level of thickness. If the metal is exposed to rain, it may corrode while it is wet at the rate appropriate to immersion in impure, well-aerated water, but the rate will fall when it dries. To predicting the atmospheric corrosion contain the following consideration they are time of wetnes, average temperature, average relative humidity, atmospheric purity and so on. In general it is clear that wetness, extreme temperatures and strong electrolytes contamination are included for the highest rates of corrosion. The simplest and longest method to determine the corrosion loss is weight loss analysis. A weighted specimen of the metal is introduced into the process, and later removed after a particular time interval. The sample is then cleaned of all corrosion products and is reweighed. The oxygen, water and strong electrolytes are major required to produce rapid corrosion. The absence of one or more of these agents may be done by a different types of coatings, ranging from noble metals and vitreous enamels through thick polymeric coatings (e.g. polyethylene, nylon and PVC) and thin coatings of polymer or greases and painting the metals to wrapping papers. some of the different coatings are metal flims, polymer coatings, vitreous coatings, conversion coating, painting ,sacrificial coatings etc..Salt spray testing method is the most standard and commonly used method for corrosion testing of metals. It is usually testing, surface coated and finished material to check the degree of coating. It gives corrosive attack to the metals to check the corrosion in order to suitable coating of metals. Other than metals, stone, ceramics, polymers may also tested by salt spray testing machine. The standardization ASTM B117 of this equipment is occurs in the year of 1939. The other standards of these equipment are ISO9227, JIS Z 2371 and ASTM G85.

## II. LITERATURE SURVEY

### A. *Xiao Lei Li1, Jayaraman Narenkumar, Aruliah Rajasekar Yen-Peng Ting (2018)*

These study was about mild steel and copper at cooling tower environment. Electrochemical and surface analyses of both metals where happened in presence of bacteria and inhibitor.so Surface analysis of the MS and Cu coupons revealed that biofilm was developed with increasing exposure time in the field study . In the laboratory process sedimentation of polymeric substance over the metal surface was identified and these makes pitting corrosion on metal surface. The present study concluded that MS was very susceptible to biocorrosion, compared to copper metal in cooling water environment. Inhibitor and biocide causes biocorrosion due antibacterial and anti-corrosive properties.

### B. *F.F.Chena, M.Breedona, E.D. Sapperb, W.Ganthera, D.Laua, I.Colec (2017)*

A microclimate model was developed tocreate a virtual NSS test for evaluating the response of coated metal surface to controlled environments. The presented model is able to interact with other corrosion models and utilise empirical data to predict pit growth rate. Inhibition efficiency of coating systems can be assessed and compared under different microclimates. This work demonstrates an effective approach for simulating environmental conditions for pit corrosion evaluation and inhibitor assessment.

### C. *J. Alcántara, B. Chico, I. Díaz, D. de la Fuente, M.Morcillo (2015)*

The specimen was anlaysed for twelve month at marine conditions at chloride deposition rates of 70–1906 mg $Cl/m^2$ day. A study of some environmental parameters and their influence in the airborne chloride deposit on the site has been accomplished. The corrosion rate of mild steel and its corrosion layer and atmospheric salinity of the location are studied. In addition to lepidocrocite,goethite,akaganeite and magnetite contents were found in the corrosion products.

### D. *M. Prakash, S. Shekhar, A.P. Moon, K. Mondal (2015)*

The effect of machining parameters (rake angle and turning speed) at fixed feed rate and depth of cut on corrosion behavior of mild steel is addressed in the present study along with analysis of tribological properties of the machined samples. Immersion and salt-fog exposure tests in 3.5% NaCl are carried out to understand the corrosion behavior of the machined samples. Detailed microstructural characterization of the machined samples (optical metallography and scanning electron microscopy) and their rust constituents as determined by Fourier transform infrared spectroscopy is used to establish microstructure-properties correlation.

### E. *E. Palme, J. M. Puenteb and M. Morcillo (1998)*

The comparison of atmospheric corrosion mechanism of the 55%Al-Zn coating (Galvalume) on the steel with the behaviour of galvanized sheets (Sendzimir). Research has been carried out for both the coated steel and galvanized steel in different types of atmosphere condition in different locations at Spain, Brazil and Portugal. The galvanized coating sheets which suffers a generalized attack of its surface. But the 55%Al-Zn coating undergoes a localized type of attack in steel which commences in the interdendritic regions of the material. chemical passivating treatment is used for additional protection.

## III. ANALYSIS OF CORROSION RATE IN MILD STEEL

The simplest and longest method to determine the corrosion loss is weight loss analysis. A weighted sample of the metal is introduction the process and later removed after a reasonable time interval. The sample is then cleaned of all corrosion products and is reweighted.

$$\text{Corrosion rate } (C_R) = \frac{W_b - W_a}{A*T}$$

Where,

$C_R$ = Corrosion rate,
$W_b$ = Weight before process, (g)
$W_a$ = Weight after process, (g)
$A$ = Exposed area, $(mm^2)$
$T$ = Exposure time (hr)

**SPECIMEN 1:**

$W_b$= 109 g
$W_a$= 107.34 g
T=72 hr
Length = 200 mm
Breadth = 100 mm
A= l*b
A =290*45 $mm^2$
A =13050 $mm^2$

$$C_R = \frac{W_b - W_a}{A*T}$$

$$C_R = \frac{109 - 107.34}{13050*72}$$

$$C_R = \frac{1.66}{939600}$$

Corrosion rate = 0.0000017667 (g/$mm^2$ hr)

**SPECIMEN 2:**

$W_b$= 165 g
$W_a$= 162.65 g
T =72 hr
Length = 200 mm

Breadth = 100 mm

A= l*b

A =200*100  mm$^2$

A =20000 mm$^2$

$$C_R = \frac{W_b - W_a}{A*T}$$

$$C_R = \frac{165 - 162.65}{20000*72}$$

$$C_R = \frac{2.35}{1440000}$$

Corrosion rate  =  0.0000016319 (g/mm$^2$ hr)

### IV.CONCLUSION

A mild steel specimen is tested with this fabricated salt spray testing machine and the output of the specimen is obtained by weight loss method. From this corrosion mechanism the obtained output of the materials which can also be used in automobiles, marine, even in day to day life. It always never deals with the automobile parts or marine parts but also the materials that are in regular use such as knife, building construction tools, pipes etc. So from this mechanism we can just extend the life of the materials or specimen or automotive parts.

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