CORROSION BEHAVIOR OF DIFFERENT COATINGS ON AUTOMOTIVE COMPONENTS

DISSERTATION-II

Submitted in partial fulfilment of the requirements for the award of the degree of

Master of Technology

In

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Submitted by

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DECLARATION

I hereby certify that the work being presented in the dissertation entitled **"CORROSION BEHAVIOR OF DIFFERENT COATINGS ON AUTOMOTIVE COMPONENTS"** in partial fulfillment of the requirement of the award of the Degree of Master of Technology and submitted to the Department of Mechanical Engineering of Lovely Professional University, Phagwara, is an authentic record of my own work carried out under the supervision of **Mr. RAHUL YADAV**, **Assistant Professor,** Department of Mechanical Engineering, Lovely Professional University. The matter embodied in this dissertation has not been submitted in part or full to any other University or Institute for the award of any degree.

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

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The external viva-voce examination of the student was held on successfully _____

Signature of Examiner

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ABSTRACT

This research thesis was observed to reduce the corrosive nature of automotive materials by using different corrosion resistive coatings. This phenomenon was identified to increase the life span of aluminum alloy metals which are used in automobile industries.

This dissertation advances the state of knowledge on reducing the corrosion and the strategies of mitigation. A range of corrosive adhesives was used to coat over these automotive parts to stop corrosion. Conformal coating was identified as an efficient and effective mitigation process to reduce corrosion on these automotive materials.

This thesis work done by me for nearly four months on the research work entitled as **"CORROSION BEHAVIOUR OF DIFFERENT COATINGS ON AUTOMOTIVE COMPONENTS".** In this thesis work I gave an over view about the various automotive parts which are made of aluminum alloys and their properties and the methodologies followed for different coatings. Also evaluating the corrosive properties after testing the corrosion levels based on salt spray test.

Chapter 1

1. Introduction

Corrosion is a natural process where refined metal is deteriorated to more chemically stable form such as hydroxide or sulfide with the surrounding environment. Due to oxidation of metals to the atmosphere, the asset of these metals will be condensed which leads to pits, cracks and metal degradation. Both the type of metal and the environmental conditions, predominantly gasses that are in contact with the metal, determine the form and rate of deterioration. This corrosion can be deformed in a wide area with uneven pattern in corrosion of materialist. It's a diffusion controlled process it occurs only on exposed surfaces which are not well coated with anti-corrosive coatings.

Both the type of metal and the environmental conditions, particularly gasses that are in contact with the metal, determine the form and rate of deterioration.

All metals can corrode based on their exposure. Some are like pure iron which corrodes quickly than any other metals because it has more oxidative molecules. However, stainless steel which combines iron and other alloys, is slower to corrode and is therefore used more frequently than pure iron due to its strength. Some group of metals, called the Noble Metals, are much less reactive to others which result, they corrode rarely. They are, in fact, the only metals that can be found in nature in their purest form. The Noble Metals, not surprisingly often very valuable if they include copper, palladium, silver, platinum, and gold.

1.1 Types of Corrosion

There are many different reasons for metal corrosion. Some can be avoided by adding alloys to a pure metal. Others can be prevented by a careful combination of metals or management of the metal's environment. Some of the most common types of corrosion are described below.

a.) Environmental Cracking:

It's a type of corrosion where all the combinations of environment effects combine to affect the metal to corrode. It can be either chemical, stress and humidity with different temperatures. Some of the environmental corrosions are corrosion fatigue, liquid metal deterioration.

b.) Intergranular corrosion:

This corrosion will occur due to the granular boundaries present on the metal due to the high content of impurities present on the metal. These edges are more vulnerable to corrode than other parts of the metal.

c.) High-Temperature Corrosion:

These corrosions mainly happen to occur where fuels and oils are flowing in heavy machinery with uneven temperatures. This can also occur in combustion chambers where vanadium or sulfates normally are very corrosive in nature with the metal alloys even with the stainless steel surfaces.

d.) General attack corrosion:

It is the most common process of corrosion which is caused by electrochemical reaction that results in decaying of the metal. This corrosion occurs until the point of failure of metal is identified. It is also called a safe form of corrosion due to its predictability level. Sometimes it can be controlled and manageable.

e.) Flow-Assisted corrosion:

FAC will remove the protective layer of coating on the metal surface when dissolved in water or by wind, which exposes the underneath layer to corrode fastly. This corrosion is also known to show cavitation on metal surfaces.

f.) Fretting corrosion:

This type of corrosion occurs due to continuous loading and unloading things which also causes wearing of metal edges or even with some slight vibrations. This corrosion will result in pits and grooves on the metal surfaces.

g.) Localized corrosion:

This corrosion attacks in the form of small portions on the metal. This will create small holes on the surface and even on water stagnated areas on the metal surface which are normally found under gaskets.

h.) Galvanic Corrosion:

It's a corrosion where two different metal surfaces are in contact with each other. A galvanic corrosion occurs in between two metals where one acts as a cathode and other act as a anode. The anode plate starts to deteriorate fastly than the cathode plate. This will

Be caused due to electrochemically unsimilar metals or metals are in electrically in contact with each other.

i.) De-alloying:

It is a selective corrosion of metal alloy in a metal plate. This is due to zincification of unstable brass.

1.2. Converting Corrosion Rates:

a.) To convert corrosion rate between the mils per year and the metric equivalent millimeter per year (mm/y), you can use the following equation:

b.) 1 mpy = 0.0254 mm/y = 25.4 microm/y

c.) To calculate the corrosion rate from metal loss:

d.) mm /y = 87.6 x (W / DAT)

e.) where:W = weight loss in milligrams

D = metal density in g /cm3

A = area of sample in cm2

T = time of exposure of the metal sample in hours

1.3 Salt Spray Test Machine Parameters

Working sizes

Volume	**Internal dimensions**
108L	**600mm x 450mm x 400mm**
270L	**900mm x 600mm x 500mm**
480L	**1200mm x 850mm x 500mm**
800L	**1600mm x 1000mm x 550mm**

Power Requirements		**220/230V, 50/60Hz**
Electricity		**1 phase or 3 phase as requested**
Temperature Rangesalt	**water test**	**35° C to 47° C**
Corrosion resistant test		**50° C to 63° C**
Temperature Fluctuation		**±1°C**
Humidity Range		**95%RH**
Humidity Deviation		**±1% to ±3%**
Temperature Controller		**HMI+PLC**
DISPLAY		**LCD**

Figure 1 – Salt Spray Analysis Machine

Chapter 2

2. Scope of Study

This corrosion study helps in controlling the problems by fixing the exact property affecting the quality of the metal. It helps to predict the metal solidity and strength while using those metals. Corrosion study also helps in identifying the impurities present in the metal and also helps to find the root cause for the corrosion mechanism. This corrosion is quite different in different metals based on their metal alloys concentration.

This corrosion helps to coat different kinds of passivation layers on metal surfaces to prevent corrosion. These corrosion levels can be analyzed enough to completely unveil the effect. In these cases, a pre analyzed treatment is applied to avoid such corrosion levels. Corrosion even depends on size and shape of the material with its mechanical properties.

confirm metal components have the lengthiest possible life. For metal components run in severe applications, Metal Coatings offers the most broadly used corrosion protection coverings in the industry with resistance to great chemical applications for extreme run life.

Metal Coatings Corporation brings three decades of expertise to the application of corrosion resistant coaters, along with the advantage of an 80,000 square foot facility staffed around the clock with coating industry professionals ready to handle rush projects.

Accelerated corrosion testing is used for numerous purposes to mimic the conditions that a manufacturer or trader product will be visible to in actual service environments. As the performance of a manufactured goods is often associated to the service atmosphere where it is placed, it is of the greatest importance that products are manufactured captivating the various parts of inclement weather and corrosive ecological conditions into contemplation.

The usage of test center exposure analysis provides manufactures and providers with an innovative understanding of the restrictions of the components used in factory-made products

prior to the buying and or insertion of these products in a larger component of final manufactured goods. This accelerative thinking methodology not merely edges the period, energy and income paid out of mediocre products however limits the risk by losing fair position as well as clientele and consumers due to substandard product performance. In an outer layer, ACT is used to prompt corrosion plus failure in a fairly small period of stage before compared to corrosion shaped as a natural event. This offers the earnings for verdict manufacturers to pull, redesign via alternate supplies, otherwise eliminate a specific seller with substandard products in total.

Accelerated corrosion testing is succeeded by imperiling the test constituents toward the conditions that are new severe than regular service situations. This results in smaller lives than ordinarily observed. For instance, the results acquired at greater temperatures (i.e. enhanced conditions) may possibly be extrapolated to chamber temperature (i.e. to the standard conditions) to acquire an estimation of the life below normal circumstances.

Later the main purpose of the accelerated testing exists to wrap the common degradation method into a practically to a small period, it is vital that the circumstances imitated by accelerated testing, have nearly direct connection to usual operational surroundings. It is besides very desired to maintain unsuccessful devices in a state that tolerates them to stay carefully observed to define the reasons of failure.

Chapter-3

3. Objectives of Study

Without the corrosion tests we can expect to get many failures in our everyday usage of machine and automobiles.

As the technology advances, we are continuously pushing technology to its limits. These even be applied to metal materials, it's just safety is every time challenged by efficiency. To light this challenge, we implement a wide range of tests to control corrosion in various metal manufacturing in the simulation or by real environmental conditions. All these tests took place in electrochemical laboratories to prevent or eliminate the chances of corrosion.

Some of the corrosion tests with aims such as

- Determining the time taken for corrosion in a certain period of time
- By evaluating the materials
- By analyzing the effect of environmental gases and chemicals on the material which we are testing.
- By accessing the field testing in the work place.

These above tests often provide the critical boundary limits of the test materials which need to changed or aligned to prevent corrosion from being used in a perilous state.

The main objective of this thesis is to avoid or prevent corrosion of metal by adding effective corrosion resistive coatings. We can control corrosion by changing the properties of metals by adding alloys. We can even prevent corrosion by performing research on various alloys formed on corrosion resistance steels in the concrete interface using microscopic methods by identifying the morphology of metals. Even we can use spectroscopic methods for analyzing chemical composition and to find crystalline phases, diffraction methods are used.

- To develop suitable metal alloys for automobile bodies.
- To develop Al-alloy from these analyzing tests.

These analyses will help in manufacturing different alloys with less corrosive in nature. This corrosion level increases the failures in industries infrastructure with machines, which are costly to repair or assemble. Later which leads to losses for the industry. By this corrosion analysis we can able to know under which circumstances we need to use and at what temperatures the metals are used. These metals are sometimes selected by trail or on the basis of what was used before. As a result, the coatings on these materials won't last long enough to stop corrosion on those materials.

Chemical and physical properties are described based on the materials. It helps to manufacture metals which are non-corrosive in nature. Resistance to acidic and alkaline chemicals also can be identified under what environmental conditions. This data can be achieved in formulae and application techniques. These solutions are more helpful in types of coating levels and amount of corrosion resistance.

Chapter 4

4. Review of Literature

Mosab Kaseem et al. 2015 [1] The formation of highly resilient coating for the improvement of corrosion effects of Al-Mg-Si alloy. In this two solutions A and B. In single study they recycled plasma electrolytic oxidation (PEO) was proficient in a citrate-aluminate electrolyte and in other potassium hex fluorosilicate (K2SiF6. Assumption was mostly due to the constant distribution of F and Si components which lead to development of insoluble combinations such as Sio2 and AlF3 in the coating with addition of K2SiF6 will be good in refining reduction of corrosion performance.

Jinsun Liao et al. 2015 [2] Corrosion assets of AZ31B, AM60, AMX602, and AZ91D alloys unprotected in actual atmospheric situations for 3 years. They identified about the different shapes of the coverings, which are existing on them. They likewise stated that how abundant these coatings comfort the material to counterattack the corrosion after smearing these coatings. Only Dual hydroxide cover was present on the Al metal coating. Four Mg alloys exposed different surface presence by clarifying morphology. Lastly, AZ91D alloy has the maximum corrosion rate.

S. Manivannan et al. 2015 [3] The corrosion deeds of AZ61+XCe alloy at altered stages of analysis about 18h at 180^0-220^0 C through 3.5% of NaCl solution. Afterward in X-Ray deflection and ageing allocating has significantly influenced erosion morphologies. Salt spray test results shows AZ61 alloy with 1.5 wt% Ce aged 220^0 C exbhit better corrosion opposition. With ageing heats, β phase propagates rapidly in a endless network and cultivates up to 220^0 C then above it it surprises to fade missing towards the interior stratums of coating.

K. Bobzin et al. 2014 [4] Morphology and layer depth of the metal and hydrogen inclosing DLC layers. The DLC coatings nc-ZrC is based on a related installation process as ZrC without shear lax graphite-like upper layer and the categorized changeover of morphology and material

goods alongside coating thickness. Cross sectional SEM micro-graphs reveal a plane surface for all ZrC variations. The pure zirconium interlayer is clearly noticeable to columnar morphology.

S. Fatimah et al. 2014 [5] The combination of ZrO2 and Sio2 Nano-particles into coating of 6061 Al alloy by PEO was magnificently attained. Microstructural exploration showed that small porosity of the covering was recognized to the affinity of the nanoparticles to seal the cracks and wedge the pores in the coat. The porosity diminished by ~2.62% when either SiO2 or ZrO2 nanoparticles was incorporated, while significant decrement of porosity by 7.61% was attained when both nanoparticles the corrosion protection properties of the coating as well as provided firm oxide combinations against saturation of ions as of corrosive environments. To précis, the combination of together nanoparticles as a micro pores blocker and flaws plaster, namely synergetic special effects ,in lessening the microstructural faults led to loftier corrosion properties as associated to the single unification of the nanoparticles.

Shun-Yi Jian et al. 2014 [6] An electrodes Ni-P sum was arranged on the MAO layered AZ31B Mg alloy later stimulation controlling using a St-co-NIPAAm/Pd nano-particles as activator. Lastly nickel film with intensely improved connection and crack-free is designed on the surface of MAO covered AZ31B Mg alloy. The result of coating resolution caused destruction to the MAO film. As a result, H+ ions could quicken the mutilation of MAO coat and weaken its corrosion opposition.

Chor Wayakron hetphaisita et al. 2014 [7] Improved NR was recycled with renewable adapted PET and marketable isocyanate (MDI). Blend of these two resources increased toughness, adhesion, effect, Erichsen and flexible of the covered film. This combination increases the smoothness and elastic nature of the portion. The thermal power and corrosion resilient of PDMS covered films stood advanced than HLNR. The union films remained higher than that of HLNR (Hydroxl content). The bond strength and hydrophobic property of Si-O enhanced the degration temperature and weathering resistance over that of the C-C linkages.

Ke-bing Zhang et al. 2014 [8] The Cerium nitrite form unsolvable hydroxides or oxides in NaCl result. The accumulation of cerium Nitrate to Dacromet covering not only shrinkage more micro-cracks and pin-holes clearly and agrees formation of a further solid coating. Associated with Dacromet covering, the anodic shelter function to steel substrate and bigger the impedance ideals at Great Frequency area and low-frequency area.

R. Rajeshkumar et al. 2014 [9] The microstructure of Mg-Sb dualistic alloy poised of α-Mg matrix and Mg3Sb2 stages. The totaling of Sb extra than 4 wt% toughened the Mg3Sb2 parts and henceforth the morphology reformed from spike to plate profile. The corrosion opposition of Mg-Sb double alloys condensed with the upsurge in Sb contented. In similarity, Si add-ons enhanced the corrosion performance of Mg-Sb-Si ternary blends.

Dan Songa et al. 2013 [10] The defensive covering was fabricated on the Mg-2Zn-Mn-Ca-Ce Biomedical Mg blend finished the hydrothermal manufacturing method with de-ionized water as the reagent. The made-up coatings were mainly self-possessed of Mg hydroxide. The coatings were generally uniform and compact, and effectively reduced the bio-degradation of the Mg alloy substrate. The corrosion opposition and protecting effectiveness of the coatings were expressively developed with growing synthesizing period.

Saviour A. Umoren et al. 2013 [11] The tallying of cations with zinc ions together organic and inorganic metals decomposition inhibitors can slowly improve the effectiveness of inhibitor. Mixing of organic ingredients are biodegradable related to inorganic supplies and are innocuous in nature. Even though the inorganic capacity blend is used in a little quantity. These combinations help in anti-corrosion points.

Yang Yu et al. 2013 [12] Nitriding usage of Ni-free SUS445 stainless steel, comprehends higher gratified of Cr (22.1%) was directed at 1200 C. The electrochemical check of the Cr-N layered SUS445 sample estimated the consequence of the chromium having nitrides molded after the nitriding usage on the corrosion opposition of the SUS445 stainless steel. The CrN and Cr2N chapters are measured the main object for the exceptional corrosion opposition of the nitride SUS445-N stainless steel.

X. Zhang et al. 2013 [14] Phosphating action had an significant effect on the growing of phosphating film, and finest treatment period was 5 follow-ups. The surface irregularity had a excessive impact on the wettability of magnesium blend. The surface dynamism and phosphating film load stretched to maximum rate when phosphating behavior. The phosphate AZ31B piece had a enhanced corrosion opposition in a squat retro of time. The corrosion opposition of magnesium alloy was amplified greatly via composited through glass fiber/epoxy prepegs.

S. Fatimah et al. 2013 [15] The assimilation of ZrO2 and SiO2 nanoparticles keen on the coating of 6061 Al contaminant via PEO stayed successfully attained. This solution seals the claps in the metal to wedge the openings in coat. The porosity diminished to &.61% when nanoparticles were recycled. The grouping of together these nanoparticles as a micro apertures blocker and flaws filler, specifically synergetic things, in minimalizing the microstructural faults led to greater corrosion belongings as matched to the distinct unification of the nanoparticles.

Ping zhao et al. 2005 [16] creep corrosions are a noble metal plating but then also a non-metallic surface. It possibly will be repeated in a profligate manner by consuming heavy production testing. Environmental situations, mostly gas attentions and humidity remain the dominant features above this creep corrosion. It is recognized as the mixture of copper chlorides, copper oxides and copper sulphides. These pre coated settings transfer highly trustworthy risk owed to the creep corrosion in event of mold complex arrangement frequently in harsh temperatures.

Yuan-Ting et al. 2017 [17] there remain four baicilin cuttings specifically methyl ester, ethyl ester and propyl ester existed synthesized in laboratory for consuming in medication. These be present eco approachable inhibitors on the weathering of aluminum in hcl solution by loss of electrochemical technique. The allowed energy of adsorption remained performed to begin the corrosion of aluminum in acid elucidation. Hence progresses the inhibition development. The

negative standards of derivatives stayed difficult adsorbed thru aluminum metal superficial which primes to defensive films on the external of the metal surface.

Yong X.Gan et al. 2017 [18] the carbon aluminum background composite toward the metallurgical approach. Clean Al. which is a lesser amount of than the metal. The salt-water was accompanied to check this trial for corrosion. The galvanic potential by means of aluminum presented improvement for corrosion modern of the composite above 100 periods lesser than regular aluminum. The physical doesn't grow malformed easily in line for to fewer corrosion. Which displays corrosion of clean carbon is sea. The aluminum consumes augmented its strong point by consuming these composite constituents.

Edoardo Proverbio et al. 2016 [19] The usage of alcohols container basis major glitches in erosion of things. The problematic was bio ethanol stayed used as a substitute hydrocarbons aluminum alloy likewise have extremely exothermic things with the hydrogen multifaceted over the massive layers which be able to edge the condensation method. The Al. alloy was existence recycled at a high temperature organized by PTFE lined with variable pressure and temperatures. This result has advanced instigation and corrosion promulgation completed during ethanol vapor point at lower corrosion hostility. This layer assistances as a shielding layer for it.

KA.Yasakau et al. 2013 [20] The aluminum material goods in contradiction of corrosion things will be compromised in line for mechanical alloy possessions. The microstructure changes such as metallic reversals are presence of intermetallic designed for single properties. The alloys patterns are in dissimilar environments through corrosion inhibitor's verified on changed aluminum scales facilities. The industry carcinogenic constituents will diminish corrosion concluded aluminum due to lone coverings on the metal section. It also has revamping properties of covering on deficiencies surfaces.

Chapter 5

5. EXPERIMENTAL SETUP

Coatings, Which We Are Using On Our Material

a.) Epoxy, air dry- cost-effective, corrosion resistant coating:

This epoxy is a gel based product which will harden after coating to the metal pieces. On contact with the metal piece due to humidity in air its becomes an opaque substance with a white layer smudge. It turns into a chalky layer which is easily wiped once it is dry. It can even resist thinners or salt solvents. We can coat number of times of times even on the single coating. These coatings can be applied with sand coatings or on plane metal surfaces.

b.) Epoxy, thermal cure- excellent impact resistance, plus corrosion and abrasion.

This thermal epoxy are two solutions Resin and Hardener. These two solutions should be mixed with 50-50% before applying on these metal plates. These greasy solution is having more viscosity than the above dry epoxy solution. The hardening time is also very less compared to epoxy dry test. This thermal epoxy test solution can be mixed according to the requirement for the metal surface area.

c.) Polyurethane- high gloss topcoat for epoxy coating:

It has high load capacity in both tension and compression and it can change its shape during loading on the body and can come back to original position once load is removed on the material. It performs better when used in fatigue loadings.it can withstand low temperatures and even tear resistance. These coated compounds even stand stable in under water. This polyurethane can withstand harsh climates and even no fungus can be stable on these coatings. This coating is ideal for wheels and other flexible parts also. It is available in various color pigments with ultraviolet shielding protection in its solution.

d.) PTFE- the original non-stick coating, able to withstand high temperature

Polytetrafluoroethylene commonly known as Teflon is mainly used in industrial applications. Its melting point is around 327°C. even insects can't have grip on this coating. It can withstand any climate irrespective of the surroundings. We can use this solution bearings, nuts and bolts so that lifespan of these metal parts increases. This PTFE is used in almost all fields to prevent corrosion from foreign particle's. Most importantly it is an ivory white color which can be blended to anything it was coated.

5.1 Experiment Procedure:

First collect four samples of four different automobile body parts. Cut those metal parts to a proper shape for testing it in laboratory. Clean those metals sheets or parts so that no dust is present on those. After that make four labels on each part of what coatings present on it. Then coat the corrosion resistant solutions on these metal parts and dry them. After that send the samples for salt spray test for 48 hours in the laboratory. This salt spray test can give us at different conditions how this metal samples behaves within a simulated environment. Finally, we can able to tell which metal parts are more likely to be used in metal parts of vehicle for avoiding corrosion which also helps to understand the strength of those materials.

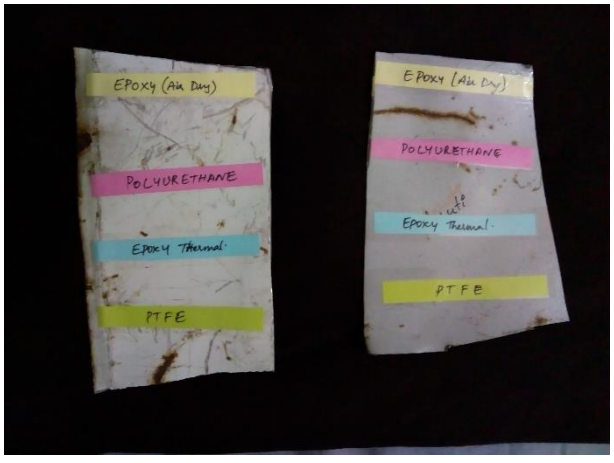

Figure 2 – *Sample 1*

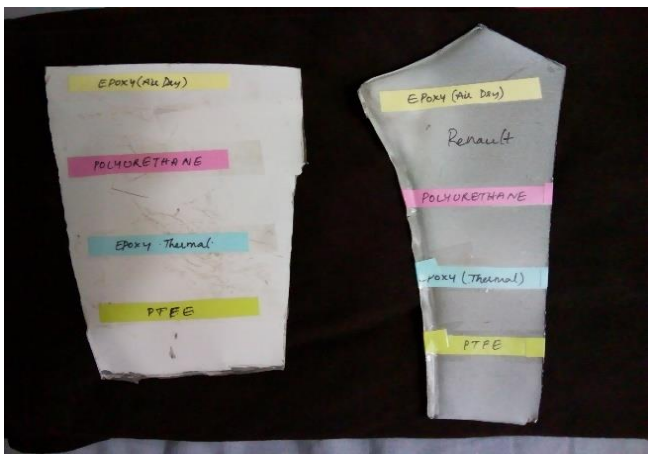

Figure 3 – *Sample 2*

Figure 4 – *Sample 3*

Figure 5 – *Sample 4*

Figure 6 – *Samples after Coatings*

After these above anti corrosive coating samples are tested with salt spray analysis in laboratory we can find the corrosion rate on each sample.

Chapter 6

6. Research Methodology

Investigating the effects of corrosion of four [4] different Aluminum alloys of 4 different automobile car body parts. On these aluminum alloys 4 types of anti-corrosive coatings are being applied before salt spray testing in laboratory. By this test we can analyze different corrosion levels on 4 different Al-alloy samples. We can even test the hardness and quality of the test samples based on their test results. In this approach, the samples that are being tested with experimental setup has been discussed below,

6.1 Material Used:

The materials used in this process are Aluminum alloys of four different car bodies in market.

Properties	Values
Atomic Number of Aluminum	13
Atomic Weight (g/mol) of Al.	26.98
Valency Number	3
Crystal Structure Type	FCC
Melting Point (°C)	660.2
Boiling Point (°C)	2480
Properties	Values
Mean-Specific Heat(0-100°C) (cal/g.°C) Thermal Conductivity (0-100°C) of Al. (cal/cms. °C)	0.219 0.57
Co-Efficient of Linear Expansion of Al. (0-100°C) (x10-6/°C)	23.5
Electrical Resistivity at 20°C for Al.(μΩ.cm)	2.69
Density (g/cm3) of Al.	2.6898
Modulus of Elasticity (GPa) of Al.	68.3
Poisson's Ratio for Al.	0.34

Table 2 - *Typical properties of Aluminum*

Designations of Al-alloys

Copper, Magnesium, Silicon, Manganese, Lithium and Zinc are the metals frequently used for alloying with Aluminum. Minor proportions of bismuth chromium, lead, nickel, zirconium and titanium too made and iron is regularly present in lesser amounts.

There are almost 300 wrought mixtures with 50 in collective use. They were universally acknowledged, initiated from USA and generally recognized by a four-character system.

Alloy Series	Alloying Element
1XXX	Aluminum 99.000%
2XXX	Copper blend
3XXX	Manganese blend
4XXX	Silicon blend
5XXX	Magnesium blend
6XXX	Magnesium and Silicon blends
7XXX	Zinc blend
8XXX	Other Elements

Table 3 *- Designations for wrought aluminum alloys*

The 1st digit (Xxxx) specifies the principle alloying component, which is further added to aluminum alloy and is used to refer the aluminum alloy sequences, i.e., 1000 series, 2000 series, and up to 8000 series.

The 2nd digit (xXxx), if altered from 0, indicates a alteration of the particular alloy, and the 3rd and 4th digits (xxXX) are recognized as arbitrary figures given to a specific alloy in those series.

7. Proposed Work Plan

Week / Month	September	October	November
Week 1	----------	Amending the problem to examine the mechanical and corrosion properties of test samples	Selection of material parts Aluminum alloys and evaluation of average properties.
Week 2	Group materialization	Literature Analysis	Learning the usage of anti-corrosive solutions
Week 3	Finding a problem	Literature Analysis	Learning research procedures
Week 4	Confirming the problem i.e, corrosion resistance on automotive body parts.	Groping various Authors research work analysis (20 research and review papers)	Finalizing that expected conventions to be approved out and developing a work procedure.

8. EXPECTED POSSIBLE OUTCOMES

Expected outcomes of proposed work are as follows:

By analyzing those above 4 experimental methods on 5XXX and 6XXX materials i.e Aluminum-Alloy we can report the corrosion levels with those methods. All these 4 samples will get corroded and these results help in understanding the corrosion phases of four different automotive metal parts. We can also know how corrosion takes place on which material and the types of corrosions according to the test process.

9. Conclusion

In this thesis work I gave an over view about the various automotive parts which are made of aluminum alloys and their properties and the methodologies followed for different coatings. Also evaluating the corrosive properties after testing the corrosion levels based on salt spray test. A refined aluminum alloy metal will be finalized and compared to the other samples of corrosive materials with having more strength even after corrosive tests. A range of corrosive adhesives was used to coat over these automotive parts to stop corrosion.

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