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[Engineering](#)



Introduction

This report is about corrosion prevention in automotive vehicles, the report first start with defining the corrosion and its basic reaction, it then looks at basic reaction of unprotected body shell of car., it will then further discuss method of preventing corrosion in cars emphasising more on the coating system. Also the report will look at advantages of having monitoring system in assessing the corrosion prevention, the new development and future prediction and finally the report will end with a conclusion summarising the key point the key pint in the report.

Definition of corrosion

Generally corrosion is defined as the reaction between a material and its environment which results in the degradation of that material. To be more specific, it is the oxidisation of the metal with the environment that result in the deterioration in the mechanical properties of the metal. That can be represented simple as www. international-marine. com $4\text{Fe} + 3\text{O}_2 + 2\text{H}_2\text{O} = 2\text{Fe}_2\text{O}_3$. H₂OIron Oxygen Water Rustand in the car body the formula is written as Iron + Oxygen + electrolyte = Rust (iron oxide)For corrosion to take place it normally requires three things to be present , metal , oxygen and moisture and for the case of the automobiles electrolyte should be present. Normally corrosion is fast when salt is present in the water, it dissolves in water hence forming an electrolyte, while the ion in solution speeds up the corrosion rate. The unprotected body shell of automotive is likely to be made of low carbon steel, when alloyed steel is exposed to the atmosphere without protection the surface will take on reddish – brownish

colour after a while which indicate that the material is corroding or rusting and the basic corrosion reaction that may occur is base on this equation

$$\text{Fe} + \text{SO}_2 + \text{O}_2 \rightarrow \text{FeSO}_4$$
$$\text{Fe} + 2 \text{H}_2\text{O} + 3 \text{O}_2 \rightarrow 4\text{FeOOH}$$

http://www.wiley-vch.de/books/sample/3527323244_c01.pdf

When its protected the steel is typically coated with zinc or zinc alloy 8-10mm (course work tutorial Northampton university). However aluminium is preferred for the body shell than steel because of because of its weight, aluminium has a density of density 2.7 when compared with steel which is 7.8 (course work tutorial Northampton university). There are three basic type of corrosion protection that is used in today's automobiles

- 1- Galvanic or zinc coating

PaintAnticorrosion compoundGalvanising is the process that involves coating iron with zinc and its one of the most used method of corrosion protection that is currently applied in the automobile manufacturing industry. So during galvanising the iron is dipped into molten zinc and since zinc is higher than iron in the electrochemical series. Even if the zinc coating is scratched, zinc will sacrificially protect iron (books.google.co.uk)Paint provides barrier between the steel surface and atmosphere such that impurities and moisture in the air cannot interact with the steel surface hence protect the steel from corrosion. However if the paint barrier is broken or scratch then the surface is not protected anymore and corrosion will take place, the paint is effective only when film is still intact (google.co.uk/).

Anticorrosion compounds it an additional coating applied over and under the paint film these can either be applied at the manufacturing time or after. The two main types of anticorrosion coating are

- Petroleum base compound
- Wax base compound

The best method of corrosion protection is believed to be the

use of a zinc coating with a thickness of 7 – 10 µm. A thinner (2 – 5 µm) zinc-nickel coating protected against corrosion for less than 7 years in most cases. (nile. northampton. ac. uk). On the galvanized steel the zinc forms a natural barrier between the steel and the atmosphere. As the zinc corrodes a layer of zinc oxide is form on the surface and unlike the iron oxide the zinc oxide adheres to the zinc coating tightly forming a barrier between the zinc and the atmosphere when the surface of the finished is damage zinc coating under goes corrosion sacrificing itself to protect the iron under it. The resulting zinc oxide actually forms a protective coating and repairs the exposed area of the steel. Thus zinc perform two jobs first it provides galvanic protection and the second forms a repair over the exposed steel with a layer of zinc oxide.

Coating system

There are various coating system that is used in the prevention of corrosion that is available such as organic, inorganic and metallic coating. In terms of which is green technology there are several factor to consider. These factors are pre-treatment requirement, paint thickness in terms of the energy involved, the cost as well as the require thickness proportion, hazard such as hazardous nature of the Binder, issue of waste in terms of disposability, sustainability in terms of sustain source of the binder or the source of the solvent and finally the end of life issue in terms of binder and pigment recyclability. The following is the main coating system

Powder Coating: its normally done by passing it through the oven, the main disadvantage with this is there is very little waste since uniform coating is achieved

Electrostatic spraying that mainly applicable to polymers. Chemical

vapour deposition -its high quality coating method and therefore and therefore costlyPhysical vapour deposition PVDHowever the most green coating that is environmentally friendly suitable for a green car is believed to be the electro-deposition, this coating technology employs a closed loop system that ensures utmost paint usage and that the main part of the volatiles is water, however the big issue is that the paint may have volatile organic content (VOC). The VOC are of concern since they contain some solvent that produce toxic smoke that pollute the atmosphere hence endangering human being. However the new development in this field is cathode electro-coatings that use resin systems that let a lower level of flow solvent to be utilised. These novel binders also use cross linkers that have considerable lower levels of blocking agents and lastly the resin system is designed to give a minimum level of cracking products produce by polymer degradation in the baking oven. <http://nzic.org.nz/ChemProcesses/polymers/10F.pdf>

Advantages of having modern quantitative

Corrosion Monitoring employ a broad range of measurement techniques. Some of these techniques includevisual inspectionmagnetic particle flaw detectiondry penetratesHowever the most effective and generally applied testing methods that is appropriate for the monitoring of corrosion is the Non Destructive Testing (NDT) method which includeelectromagnetic testingultrasonic testingguided wave testingradiographic testing http://en.wikipedia.org/wiki/Ultrasonic_testingCorrosion monitoring techniques can help in several ways: it provides an early warning system that helps in managing corrosionIt helps studying the connection of the changes in <https://assignbuster.com/contents-corrosion-prevention-introduction-engineering-essay/>

system parameters and their effect on system corrosivenessHelps identify corrosion problem, diagnose its root and then rate the controlling parameters, such as temperature, pressure, and rate. Flow and PHHelps evaluate corrosion prevention and control methods effectiveness. Helps provides information that reveals maintenance reports on the requirement any ongoing condition of plant. <http://www.alspi.com/introduction.htm>

Future prediction of coating system

Previously various methods considered to improve corrosion prevention were to improve the strength of structures that included modification such as the use of protective coatings; corrosion inhibitors as well as corrosion resistant reinforcement; however the present advancement of corrosion technology and communication such as the cathodic protection corrosion monitoring system could be combined with this methods will be the first step toward a long term control and monitoring system that is cost effective by 2020 and beyond futureAn example on device that can be placed in car that controls corrosion alternative to the coating system of inhibiting corrosion, is the electronic corrosion device that can be placed on the body of the car, the device work in such a way that it loads a small static charge into the entire body hence interfering with the corrosion on areas where the paints coating is lost, a similar approach on naval vessels and underground pipelines have reduce corrosion.

6- Conclusion

In conclusion for corrosion to take place it needs three things to present metal, oxygen and moisture or electrolyte for automobile and that

corrosion is first where salt is present. When the unprotected body shell of automotive is exposed to the atmosphere corrosion will occur forming reddish - brownish colour on its surface. There are various methods of protecting corrosion among these are galvanic or zinc coating, paint and anticorrosion compound, and according to the report the best method is the zinc coating process. The corrosion monitoring techniques are very important on the prevention of corrosion as it saves a lot fortune that would have been otherwise spent on corrosion repairing. Finally the future market trend indicate a positive and advance move toward a better material and coating system as well as advance use of technology in monitoring, assessing and detection corrosion device.