

Analysis Different Types of Coating Removal Techniques in Aerospace Industries: Comparative Study

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Abstract: In the recent years, aviation industry in terms of corrosion have been undertook with million pounds. Therefore, by appropriate maintenance and husbandry, these effects could be decreased. Most of the aircrafts could be maintained by long term and short term inspection check. Nowadays, one of the chief aims of using Coating removal methodologies in controlling the amount of corrosion in aviation industry. It includes High pressurized water, Sponging media, plastic media extracted from crude oil and bio engineering basic media. If the Coatings removal techniques have not operate appropriately, it could erode metal subsurface. In this research, different types of coating removal methods in the aviation industry are being illustrated and compared together. Engineering bio-based media has more advantages than the other and it can be used between 8-15 times. All in all, due to selecting the greatest appeal of proper method would be considered the safety and issue of operator's health as the most common criteria.

Keywords: coating removal, aviation industry, engineering bio-based media

1. INTRODUCTION

1.1. Corrosion

Material and surrounded environmental situation could cause by these two effects that often occurred simultaneously:

- Chemical (oxidation)
- Electrochemical (galvanic)

In both cases, metal was altered to the metal compound such as carbonates, hydroxides, oxides and sulphates. Corrosion stages are being contributed with two simultaneous changes. Metals are inveighed against the anodic changes, until it take under a cathodic change [1, 2].

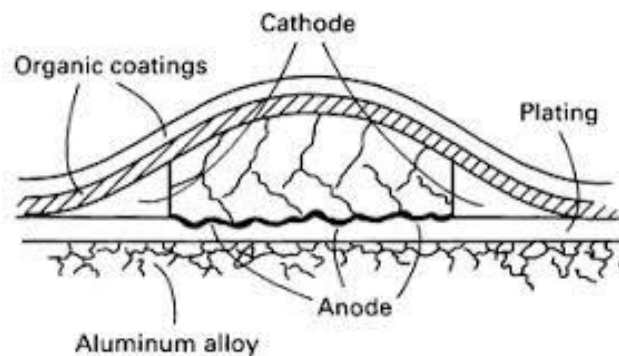


Figure1. Corrosion process

1.1.1. Types of corrosion that mostly seen on the aviation industry

There are several types of corrosion. This types are mostly depended on the surrounded metals among the susceptible environment, their applications, weather situation and current corrosion factor. Several types of corrosion that are being seen in the aircraft structures are listed below [3, 4].

- Surface corrosion

- Corrosion in the different material substances(with different alloys)
- Intergranular corrosion
- Exfoliation corrosion
- Corrosion stress
- Fretting Corrosion
- Crevice Corrosion
- Pitting corrosion
- Fatigue corrosion
- Microbial degradation corrosion
- Steel brittle corrosion

1.1.2. Factors affecting on corrosion.

Several factors effect on the reason, type, corrosion speed and metal extremity corrosion. Even though, some of them are out range of aircraft designers and maintenance engineer, some of them are being controlled. These factors are mentioned below:[5,6]

- Type and size of the metal
- Environmental situations:
 - ✓ Marine environmental (take in the salty water) increase the corrosion rate.
 - ✓ Humidity
 - ✓ High temperature
- Corrosive factors
 - ✓ Dust and soil in the atmosphere
 - ✓ Oil residuals in the engines
 - ✓ Remain welding particles

1.1.3. General methods for removing corrosion.

- Inspect the defections
- Neutralize the residual remains
- Remove each part of corrosion that would be convenient
- Clean the corrosion area from dusts
- Using temporary or constant coatings after painting completely

1.2. Coating

Nowadays, numerous kinds of coatings are being found in the aircraft industries. Take, Aircraft frameworks and large structures have plastic coating for example that is located on the metal surface which was followed by a largely cross sectional linking polyurethane on the top section [7]. Coatings are substantially made up four components: resin, pigment, fillers and solvents. Resin would act such a matrix for pigment and fillers. Regarding chemistry properties, several specifications could be proportionated as a coating removal techniques requirements [8, 9].

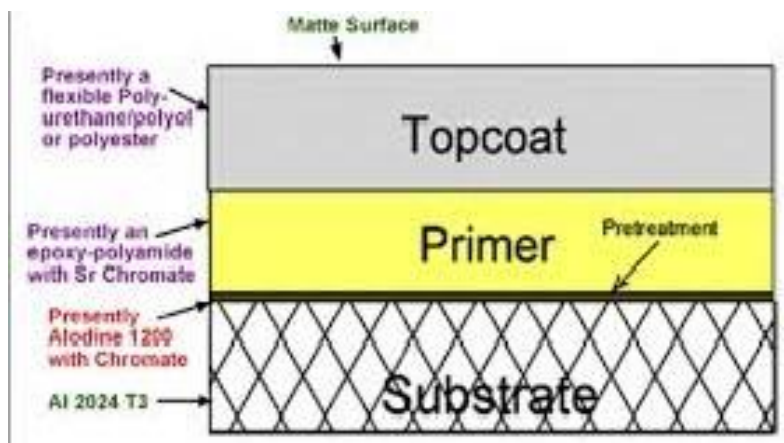


Figure2. Coating process

2. METHODOLOGY OF WORK

2.1. Coating removal methods

The vast majority of modern coating removal methods are used these below mechanisms generally:

- Disassociation of molecule
- Methodologies using thermal specification
- Impact coating methods

Disassociation of molecule section due to formation and structure of the strippers which contain all chemical strippers, are being divided to three different categories as below:

- Acidized strippers with PH below 7
- Neutral strippers (PH =7)
- Alkaline strippers with PH more than 7

2.2. Types of impact coating

- High pressurized water
- Sponging media
- plastic media extracted from crude oil
- bio engineering basic media

2.2.1. High pressurized water

High pressurized water is basically operated by very specific nozzles within the pressure of 2000 bar up to 4000 bar for the first time in the year 1990. Experimental investigation demonstrated that in these pressures only surficial coatings could be eliminated. By utilizing this methodology as a repeated activity by applying on the aircraft body which include thin layers of aluminum skins especially 0.4mm thickness, the effects on the mechanical properties of metal would be decreased dramatically. The success of this process are mostly appear on the smaller size units among a close system of water cycling.

Advantages:

- By applying appropriate observation, high pressurized water method could be act as a proper methods in removing the coatings from the strict structures with the minimum effect.
- Selective stripping is sometimes feasible

Disadvantages:

- Costs of Equipment,qualified operators and necessary engineering requirements are being observed to be moderate to high expenses.
- This method have not been used in composite structures due to performing bad impacts.
- Water must be created to remove coating debris.

2.2.2. Sponging media

Sponging media first in the middle of 1990s had been improved and industrialized by compressing the dry air against the surficial section. The type of media is a mixture of a soft foam or fibred carrier, which performs as a matrix, and several kinds of abrasive grits (such as plastic, mineral, etc.) which they are embedded in the matrix.

Advantages:

- This type of Media could be applied between 6-12 times.
- There is no chemical processes which is safe for humans.
- Selective stripping is sometimes feasible.

Disadvantages:

- The types of dust which is produced in this method like chromium may contain heavy toxin metals during the procedure of coating removals.
- It needs appropriate protection

2.2.3. Plastic media extracted from crude oil

Plastic media extracted from crude oil was first used in the year 1940 by using types of plastic which was extracted from crude by DuPont Company. The impacts of these method were not understand until in the year 1980 which was found that DCM-based chemical strippers started to emerge in the early 1980s.

Advantages

- Due to types of media, it could be used between 2-3 times.
- There is no chemical processes which is safe for humans.

Disadvantages

- One types of media which is called Aggressive type could have detrimental effects on the metallic and compositional sections.

2.2.4. Bio engineering basic media

Bio engineering basic media types was firstly appeared in the year 1991 in the aviation industry. On that time, most of the manufacturers realized that special types of bio engineering basic media which is called soft media with amount of Moh,s hardness(relatedly 2.0) and specific gravity of 1.45 g/cm³, had specific emphasis on the aviation industry on that time.

Advantages

- Regarding to the types of media and other effective parameters, these coatings could be reused between to Depending on media type and parameters 5 to 15 times.
- There is no chemical processes which is safe for humans.

Disadvantages

- The types of dust which is produced in this method may contain heavy toxin metals during the procedure of coating removals.
- It needs appropriate protection.

3. CONCLUSIONS

Because we have several equipments and factors involved, it doesn't have a simple solution for removing coatings in an aerospace industries. In terms of advantages and disadvantages of any coating in several situations, it must be economically choose a method for removing coatings in aircraft industries. Consequently, labor safety and the economic will be the two critical priority when selecting the coatings techniques.

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