Evaluation of Selective Stripping Technology

Background:

The Air Force uses chromated primers as a standard preventative measure for corrosion control. During depaint operations, the chromates from the primer systems are toxic constituents of the waste stream and in most instances, they are the sole toxic constituents.

Current Air Force coatings systems, applied to bare metal substrate, are comprised of a chromated primer in combination with one or more overcoatings to form the complete system. Periodic maintenance, and sometimes field repair, requires the entire coating system be removed to perform this maintenance. The removal of these chromated materials, while low in total concentration, creates a large toxic waste stream in combination with spent depaint materials such as plastic media, chemical strippers, and other solid waste.

Recent work done within the Air Force and in some commercial sectors suggests that specially designed coatings and removal processes have the potential to drastically reduce these toxic products. This is accomplished through use of special release coatings and/or removal techniques leaving the chromated primer intact. Technical efforts initiated by Warner Robins Air Logistics Center (WR-ALC) have demonstrated a potential for an intermediate coating that permits the removal of the topcoat, while protecting the chromated primer from damage (removal) when used in conjunction with a water blast depaint system. These evaluations, both Air Force and commercial, have met with some success and are to be used as the foundation for this assessment.

The predominant depaint methods used by other Air Force maintenance operations include dry media blasting (DMB) and chemical stripping processes. The trend is towards greater use of environmentally acceptable (EA) chemical strippers. What is lacking, and what is perceived by CTIO as beneficial to the remainder of Air Force maintenance operations, is data to establish the effectiveness of the WR-ALC barrier approach when used in conjunction with these other types of depaint processes.

This project has been given a high priority since any reduction or elimination of the chromates associated with depaint operations produces a dramatic reduction of the overall toxic waste stream.

Project Sponsor/Customer: Air Force wide
Period of Performance: Apr 98 – Sep 00

Objective:

The WR-ALC approach has demonstrated a potential for an intermediate or barrier coating permitting the removal of the topcoat, while protecting the chromated primer from damage (removal) when used in conjunction with a pressurized water blast depaint system. This barrier coating system is being considered for use by the Air Force. The coating system was developed by Battelle under contract with WR-ALC/TIEDM, and was formulated for use in the removal process to be used with a high-pressure water blast procedure. The CTIO will use readily available dry media and attempt to produce similar removal results to the water blasting process. The media/processes evaluated by this project were Type V, Type I, U.S. Technology Sponge Blast™, and SpongeJet® Silver.

Status:

A number of process parameters influence the strippability of the media. Blast pressure, media flow rate (MFR), standoff distance (SOD), angle of impingement, and traverse rates are the primary variables of DMB processes. These parameters were varied to affect stripping of the topcoat and leaving the barrier coat intact. This effort was not a true optimization of any one process or media, but an evaluation of the feasibility of various process/media parameters combinations to selectively remove the topcoat without disturbing the barrier layer.

Testing used a dry media booth equipped with an auger value with a dial in value controller with a range from 0 – 100% for the value speed. As the value rotates, an opening allows the media to fall into the blast stream. As the speed of the value and its subsequent rotation increases, more media is allowed into the blast stream, giving higher media flow rates. Media was blasted into a steel drum specially designed to remove the air build-up by venting the blast air out of the drum through the filter bag retaining the media in the drum. The blasting was timed for one minute and the media was then transferred to a bucket and weighed using a hook scale. This procedure was performed three times each at 10%, 30%, 50%, 70% and 90% flow. The weight of the bucket was subtracted from each value and the three values were averaged. A linear graph was produced from the results and became the reference from which MFRs are determined. This calibration was performed for every media type prior to testing. Testing started with the less aggressive media and finished with the most aggressive media to minimize any damaging effects of residual media remaining in the system after clean-up.

The DMB processes used for this assessment were based on readily available media. DMB processes, based on the use of the several available media, were varied in attempts to achieve acceptable selective stripping. Selective stripping was considered acceptable if the topcoat was removed with no or very minimal damage to the barrier coating.

In general, there was limited acceptable selective stripping with the DMB processes evaluated by this project. The only process tested showing any significant success was based on a sponge-like media, SpongeJet® Silver Media. A similar media had been assessed earlier in the project, but without the same control of the process parameters, and also without benefit of more sophisticated equipment specifically designed for the media. It is thought these improved process controls contributed to the successful selective stripping observed with this process. None of the other media/process combinations appeared to offer much hope of successful selective stripping.

In the development of the barrier system, Battelle Memorial Institute developed test data suggesting the most effective selective stripping with the water blast process is achieved after conditioning test materials with ultraviolet light, which is intended to simulate exposure to natural sunlight. The test materials used for these assessments under this project did not undergo this conditioning. Battelle suggested the test results associated with this project may be influenced by this lack of conditioning. It is difficult to determine whether the lack of larger scale feasibility is attributable to this factor, or whether the nature of the coating system is such that feasibility for DMB selective stripping is limited by other factors such as the formulation of the barrier coating.

A better understanding of the effect of coating aging is needed to determine the real feasibility of DMB selective stripping. The results seen with one media/process combination suggests DMB selective stripping is possible, but integration of this coating system into AF operations using stripping will not be feasible without a more thorough assessment of aging efforts on the strippability. Once these effects are studied, the coating system for use with DMB processes would most likely need optimization, which may include reformulation of the basic resin system of the barrier coating to improve the selective with DMB stripping processes.

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