Can a Plating Shop Operate Without Vapor Degreasers-Even for Wax Coatings?

By Carol Eden

Aqueous cleaning is used extensively in the plating and finishing industry and will continue to serve as an environmentally friendly alternative to other cleaning methods. What can be done, however, to remove wax coatings that have been used for masking during plating and stripping operations? The United Airlines Plating Shop in San Francisco, CA. has been dealing with this issue for years. When a vapor degreaser began breaking down at regular intervals, and the backup degreaser was unable to handle the load, it became necessary to find an alternative. This edited presentation, which was the Garland winner from the 1999 Aerospace/Airline Plating and Metal Finishing Forum, examines alternative methods used for complete wax removal, and how United Airlines discovered the specific replacement that is currently being used.

United Airlines has been using three vapor degreasers in the plating shop during the past 30 or more years. There was one in use on the racking line, which is the operation just prior to plating. Another was used on the surface temper etch line to remove light oils prior to checking highstrength steel parts for burn indications and corrosion. The third degreaser was used on the unracking line to remove wax. For the third degreaser to work efficiently, the waxed part is placed in a hot-water tank to remove the bulk of the wax, then the part is placed in the degreaser to remove the rest.

A directive from United's Safety Department required us to find a viable alternative to replace vapor degreasing. By 1995, the Safety Department placed a ban on all vapor degreasers, including 1,1,1 trichloroethane. The plating shop was reluctant until an alternative was



Fig. 1—Experimental de-wax line at United Airlines.

found. In 1996, the first parts washer was used to remove light oils. This process proved to be very effective, so the plating shop eliminated the degreaser located on the racking line.

The degreaser located on the surface temper etch line was more difficult to replace because it was the backup for the degreaser in the unracking area. This degreaser would remain idle for months at a time just so it could be used as a backup when the unracking perchloroethylene degreaser shut down. In the meantime, an alkaline aqueous cleaner was used to remove light oils prior to surface temper etching high-strength steel parts.

The degreaser on the unracking line was purchased in 1994 and installed in 1995. At the time, United did not have a replacement for removing wax. This degreaser was slightly different, because it was designed to operate at a higher temperature and operated with perchloroethylene. Use of the chemical has been questioned for years, but necessity has kept it from being banned.

Degreasers have these drawbacks in the airline industry:

- The undesirable vapors they give off
- Hydrochloric acid builds up and causes rapid deterioration of the cooling system, resulting in frequent breakdowns

• Titanium parts cannot be degreased because of the corrosion it causes in recesses that could create stress in the base metal.

Process Considerations

The first attempt to eliminate the perchloroethylene degreaser for complete wax removal was caused by problems with titanium base parts. The methods used were:

- Parts were wiped off and placed back in hot water and wiped off again
- Parts were wiped off and sent to the steam clean area for complete wax removal
- Parts were wiped off with perchloroethylene or trichloroethane-laden rags after the hot-water dip

The frustration from trying these methods and continuously failing caused the process engineer to try a new wax removal dip process. United first tried the new process in 1996. The bath worked better than wiping the parts with a rag, but areas on the parts were still covered with an oily residue. Another drawback was that the bath had an unpleasant odor, somewhat like kerosene.

The search for a suitable alternative for removing wax continued. An alternative being used by Pratt and Whitney looked promising, but parts were treated in a variety of ways following the process, depending on the need. After parts were dipped in the de-wax chemical they were:

- Placed in an oven to burn off the rest of the wax
- Placed in an ultrasonic cleaner for complete wax and oil cleaning
- Rinsed, then placed in an alkaline cleaner and rinsed again

Process Selection & Design

The first two methods were ruled out, but the third was chosen for a try. The process, however, was modified to fit United's needs. An experimental dewax line was built using the following steps (see Fig. 1):

- (1) Hot water heavy wax removal
- (2) Chemical de-wax tank
- (3) Hot water rinse
- (4) Alkaline cleaner
- (5) Hot water rinse

In all, six tanks were used, but one was a boil-off tank to prevent the dewax chemical from flowing into the waste treatment system.

Platers working in the shop were asked to participate in the testing of the process. They were reluctant and resisted using the process. They also had reservations about the process getting the parts clean, and anticipated bond problems on parts that required more plating.

Testing went very slowly. Only a few parts were tested each week. After several different people tried the process, they were more receptive to using it, but under these conditions:

- That deeper tanks be provided for the process
- That covers be installed over the chemical de-wax tank and cleaner tank
- That a single hoist be provided to transfer parts to the new line

The degreaser quit working again in a short time, so this new process had to be used on a full-time basis. It was found that the tanks were too small and the process needed more changes to make it function better. With input from the platers, the line was expanded in depth and number of tanks to process parts.

Operation & Performance

The process flow of the current dewax line is (see Fig. 2):



Fig 2—Current de-wax line at United Airlines.

- (1) Hot water wax removal
- (2) Chemical wax removal (two tanks)
- (3) First hot water rinse (two tanks)
- (4) Second hot water rinse
- (5) Non-etch alkaline cleaner
- (6) Hot water rinse

Figure 2 shows the experimental tanks and boil-off tank still on the line. There are also some tanks with spargers and one mixer included.

Pros & Cons

There are six drawbacks to using the precision de-wax cleaner:

- (1) The chemical is not allowed to get into the waste treatment system.
- (2) Combined with the wax, the chemical forms a residue that settles on the vents, hoods and tanks. This residue will contaminate tanks and could hamper the ventilation system.
- (3) The de-wax process can be expensive, because of the initial setup, chemical costs and cost of chemical disposal.
- (4) The amount of space and number of tanks required far exceed that associated with a degreaser.
- (5) The de-waxing chemical is not currently recyclable.
- (6) Waste disposal of the product is still an unknown factor.

It is anticipated that when the chemical reaches 20-percent saturation, it will solidify. With chemical lost to evaporation and fresh make-up required occasionally, the current process has not required a bath dump in a year of service. The upside of the de-waxing

- process is:
- (1) Safety—there are no toxic vapors that can escape
- (2) Quality—parts are clean enough to be acceptable for reprocessing without bond problems
- (3) It is a viable alternative, if there is enough space and money available

It appears the drawbacks exceed the upside, but United switched to chemical de-wax because of the downtime associated with using vapor degreasers. United could not afford for the vapor degreaser to be down for long periods of time, and the 1,1,1 trichloroethane degreaser was inconvenient and insufficient for our needs. Since United implemented the new de-wax process, the line has experienced down time only because of steam-related problems, not equipment failures.

Yes, a plating shop can function without vapor degreasers. PASF

About the Author



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