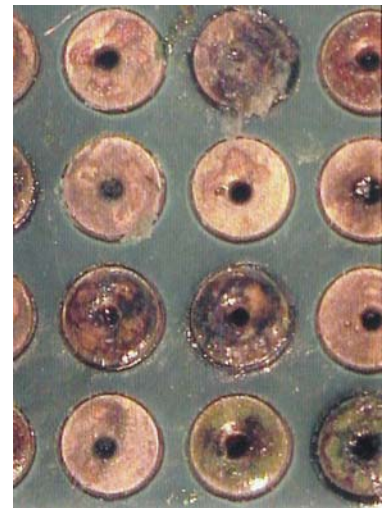


## Mean Green Corrosion

Selective soldering on ImAg boards using no-clean flux is a touchy situation  
**Foresite Inc.**

No clean fluxes are designed to be protective and insulative of boards, but it is very common when a no clean flux is used in a selective soldering process that this flux does not become fully complexed and leaves harmful conductive residues on the board. This effect can be seen on all types of board finishes, but ImAg is particularly sensitive to the aggression of these no clean flux residues.

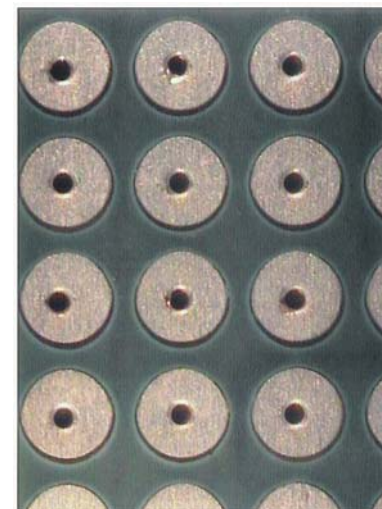
For this case, a customer was assembling ImAg finished boards using a VOC free water based no-clean flux. They were experiencing failures around selective soldering sites which showed a green corrosion. Seven assemblies, four bare boards and a flux sample were sent to Foresite for failure analysis. Using the C3 tool, we were able to extract localized samples around the failure sites involving the selective soldering process. These samples were then used for ion chromatography analysis in a Dionex™ ICS 2000 system per IPC TM 650.2.3.28 to identify and quantify ionic residue species present on these assemblies. Upon analysis, these sites showed marginal to low levels of chloride, but some levels were high enough to indicate a contribution to the attack on the silver and copper. These levels were not high enough to be the primary cause of the green corrosion. These sites did, however, show very high levels of weak organic acid (WOA) flux residues and a water carrier. These residues are very hygroscopic, and are the primary cause of the visible copper chloride corrosion. We also tested the pH around the areas of corrosion, and on a failed area pH measured 1.7, while on a reference area, pH measured 7.7. This shows how the typical residues on ionically clean areas of the board are neutral, while the no clean flux and water residues leave a strong acid on the silver finish.



Before rescue cleaning

Based on our findings, we were able to develop a rescue cleaning protocol at our site to recover these boards. We have developed many successful cleaning protocols for no-clean assemblies, and have experienced great success with their outcomes. Using 10% saponifier and 90% deionized water with a regular in-line cleaning protocol, we were able to remove the corrosion and decrease ionic residue levels to fall within the parameters for successful long term field performance.

One suggestion for prevention of this situation is to add in a secondary heating step for the areas protected by the pallet during selective soldering to make sure that all of the VOC free no clean flux gets volatilized. It could potentially help to switch to an alcohol based no clean flux, but a secondary heating step would still probably be needed and the alcohol based flux may not be aggressive enough to optimize solderability. To accomplish the secondary heating step, we recommend to use a 4-5 zone reflow oven with temperatures above the 150°C required for flux activation for 30 seconds.



After rescue cleaning



ISO 9001:2000 Certified

This situation will also be aided by adding a post-wave thermal step. The post-wave thermal step can be accomplished by either baking the boards or running them through a reflow oven making sure not to exceed flux activation temperature. If the baking option is used, bake at 125-130°C for half an hour within 3 hours of wave soldering. The more cross flow ventilation this oven has, the better the volatilization of flux trapped in vias. For the reflow option, allow the boards to dwell at 150°C for 20-30 seconds (similar to a glue cure profile) with a very gentle thermal increase and cool down. Adding this step will allow the flux and water carrier trapped between the board and the pallet to fully activate and will drive off the water carrier so that only benign, insulative no-clean flux residues remain on the board. In addition, cleaning the pallets prior to use to decrease flux build up will help to ensure cleanliness with this manufacturing process. To accomplish the pallet cleaning for this instance, we used Envirogold Envirosense 816 saponifier at 10% in a 140F bath, and then steam cleaned the pallets with a PDQ Minimax 2 steamer.

Based on these steps, this customer was able to remedy their current corrosion problems, and prevent future occurrences of the copper chloride green contamination. Selective pallet soldering allows for flux to become entrapped between the board and pallet, and it is necessary to remove these residues to achieve successful product performance. If this mistake is made, an effective cleaning protocol should be able to remedy the situation, but with proper heating and volatilization of flux, this problem is very preventable.