WHITE RESIDUES ON PCB's AFTER CLEANING – TYPICAL CAUSES

White residues
These are sometimes visible after aqueous cleaning of PCB’s after soldering. They are not usually caused by the actual cleaning chemistry, except when the formulation includes a surfactant (detergent) which if not properly rinsed away can leave a residue which resembles the more common flux related white residues. Their occurrence can only be eliminated by investigating and modifying each possible source of occurrence one at a time in order to isolate the problem in the process or material supply chain.

Polymerized Flux residue
Insoluble Polymerized flux residue can be caused by excessive temperature or time during the soldering process, (reflow, wave or hand soldering). Another variable which can have an influence is the variation in the sources of natural Rosin. Modified Resin is the basis of many no-clean solder fluxes and has a particular tendency to leave White residues when aqueous cleaned. Corrective actions can include modification of the time/temperature profile of soldering operations to reduce heat input, and reviewing the supply chain of the soldering materials to identify a flux which does not cause white residue problems.

Tin Oxide reaction residue
Tin Oxide reaction related white residues are caused by a reaction between the Solder Tin and the activation acids within the flux. The White residues in this case are Tin salts, and like all the other common sources are not soluble in water. Possible corrective actions are as above for Polymerized Flux residues.

Esterification residues
Glycol Ether solvents in the Flux carrier can react with resin compounds to form resonates such as Rosin Esters. These are also insoluble in water based cleaning agents. Possible corrective actions can include reviewing the choice of Solder Flux used.

Flux Activator residues
The presence of halides (even hidden ones stable at test temperatures) liberated by Halogens during the soldering process can cause white residues. Possible corrective actions can include reviewing the Halide content and form within the flux.

Solder Mask related residues
Incompletely cured solder masks due to poor process control at the bare board supplier, particularly the UV cured types. Soft solder mask can be attacked by both chemicals in the flux and the cleaning chemistry. Residues of uncured solder mask can appear as a White residue. Possible corrective actions include monitoring presence of residue after cleaning of batches from two bare PCB suppliers. Auditing of the curing cycle carried out by a supplier can assist in identifying curing variations. UV cured masks are susceptible to quality problems caused by variable curing. Differences in mask thickness, lamp power, or poor control of curing time from batch to batch can all cause failure to cure properly.

Salvage of White residue contaminated PCB’s
The only chemistry which can dissolve most white residues is an organic acid based solder brightener of the type used by bare PCB suppliers to prepare contact points prior to solder coating. Follow by rinsing in 50/50 IPA/D.I. water. This is not a cure, or a substitute for flux cleaning, but will salvage residue coated PCB's. Sometimes the white residues are so loosely adherent to the PCB that a wash in an active rinse such as 30 – 50% IPA + D.I. water with some agitation is sufficient to dislodge them. This will not dissolve them, but rather break the mechanical bond keeping them in contact with the substrate.

Determining whether active flux is present in visual residue
The White residues sometimes found on PCB’s using low solids fluxes are not chemically active and therefore will not of themselves be the cause of reliability issues. However, if they contain active flux residues which were not fully decomposed during the Solder process heating cycle, corrosively active material can be present which will cause problems later. One simple, if basic method of indicating the presence of active flux is gently swab residue points with an IPA cotton swab. A change in appearance by reduction of White residues indicates that active flux was present and was removed by the IPA as other stable White residues are not dissolved by Alcohols. Re-cleaning, and reviewing of the cleaning parameters should then be carried out.