SOLVAY
CHEMICAL SECTOR – SBU FLUOR

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NOCOLOK® Flux – TECHNICAL INFORMATION

FLUX SLURRY – WATER QUALITY

In general, it is difficult to comment on potential effects of trace impurities in the flux slurry water without knowing more details about the character of the contamination. There may be only very little influence on the brazing results even with 1000 μScm^{-1} conductivity. However, it is necessary to perform a chemical analysis of the water for further evaluation in each case.

The use of de-ionized water has always been recommended to prevent scale build up in the flux delivery system. Reverse osmosis (RO) water is also used successfully. There are no Solvay (nor Alcan) recommendations on conductivity or maximum hardness values (except those related to the calcium levels as listed below). The only reference Solvay can provide is the conductivity of the de-ionized water used at our Technical Services and Analytical Department in Hanover, which is below 0.2 μScm^{-1}.

As far as we know, no scientific study was yet conducted to determine water quality requirements for aluminum brazing. In collaboration with Alcan, Solvay has established guidelines for maximum impurity limits for water quality based on contamination which might interfere with brazing or cause discoloration of the brazed parts:

Calcium	<0.1%	(1000 ppm)
Barium	<0.05%	(500 ppm)
Sodium	<0.5%	(5000 ppm)
Iron	<0.02%	(200 ppm)
Copper	<0.02%	(200 ppm)
Titanium	<0.1%	(1000 ppm)
Silicon	<0.05%	(500 ppm)
Lead	<0.05%	(500 ppm)

For Chloride a maximum of 0.02% is specified (corrosion problems). Based on experiences at some customer locations with post braze odor in the past, Sulfates should be below 0.02%. Phosphates can cause problems with post braze odor too, due to the potential formation of PH_3. Silicates are known to interfere with flux activity. Borates and Silicates can cause black spots on post braze flux residue.

Residual hydrocarbons on all aluminum surfaces must be limited to the lowest level possible, due to the potential formation of carbenous residue and long term corrosion problems caused by this residue. The same applies to all other carbon containing trace impurities in the system.

Most of the above information refers to flux and flux slurry contamination. However, it also relates to other additives and chemicals in the process, particularly when those additives cannot be,- or are not-, removed from the fluxed component prior to reaching brazing temperature.

Additional Comments:

Common contaminants for flux slurries are rust, metal fines and lubricants. In addition, if an aqueous degreasing system is in place, there could be tracking (i.e. carry-over) of cleaners into the fluxer. Other contaminants might include higher than recommended levels of surfactants. Just dust and dirt are also common contaminants.

Water soluble contaminants might include chlorides (important in coastal regions), copper ions from using Cu plumbing. These last two are of concern from a corrosion standpoint. If Cu/brass heat exchangers are produced in the same plant, a single Cu particle in contact with the heat exchanger during brazing will lead to an immediate catastrophic failure (erosion).

Also, if parallel flow condensers are brazed where the extrusions are flame or arc sprayed with Zn, there will be elevated levels of Zn in the flux slurry. I have not heard of Zn particles detaching and settling in the flux slurry. Another less obvious contaminant might be the flux itself. I'm speaking of large flux residue crystals detaching from fixtures. This could lead to nozzle blockage.

It is somehow difficult to quantify the effect on the brazing process or the product except in obvious cases.

Oil contaminated slurries can lead to carbon deposits on the surface of the heat exchanger – a potential future galvanic corrosion site.

Generally speaking, it is believed that elevated levels of contaminants reduce the robustness of the brazing process – especially if you are running right on the edge in terms of flux loading.

Depending on which of the above mentioned contaminants are present, the methods to determine their levels will be different.

The easiest way to check for contaminations is a visual inspection of the slurry. The flux slurry must be free of foreign particles and not discolored. The flux powder must be distributed homogeneously without excessive flux build-up on any internal surfaces of the fluxer system. There should be neither any oil floating on the slurry surface nor on the bottom of the vessel. Increased oil (or lubricant) levels often lead to poor slurry wettability and consequently too low and non-uniform flux distribution.

For many other contaminants, only a specific chemical trace analysis of the slurry water and solids will provide reliable information. An important starting point for clean flux slurries is always the quality of the water used for its preparation.

In a production environment, frequent visual inspections are the most useful way to control the flux slurry for contamination.

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