
# Halogen free

## General

- Cl, Br and F
- traditionally present in soldering materials
- have the property of staying active on every temperature
- very interesting activators

## Question

What is the influence of these halogens on the reliability of electronic circuits that have been soldered with lead free alloys?

# Halogen free

## The chemical reaction

- $2CuO + 2Cl2 = 2CuCl2 + O2$: Cu is consumed, metal salt formation
- Halogens have the ability to react with metals
- The reaction product is a metal salt
- Metal salts have the ability to subtract moisture from the air
- When voltage is present on the board, corrosion is possible


*Corrosion*


# Halogen free

## The difference with lead containing alloys

- Strange phenomena witnessed with change over to lead free.
- Increased leakage currents
- Increased corrosion sensitivity
- Same processes with SnPb and halogens no problem
- Taking away the halogens solves the problems
- clearly related to combination of lead free metals and halogens


# Halogen free

## The water solubility of the metal salts

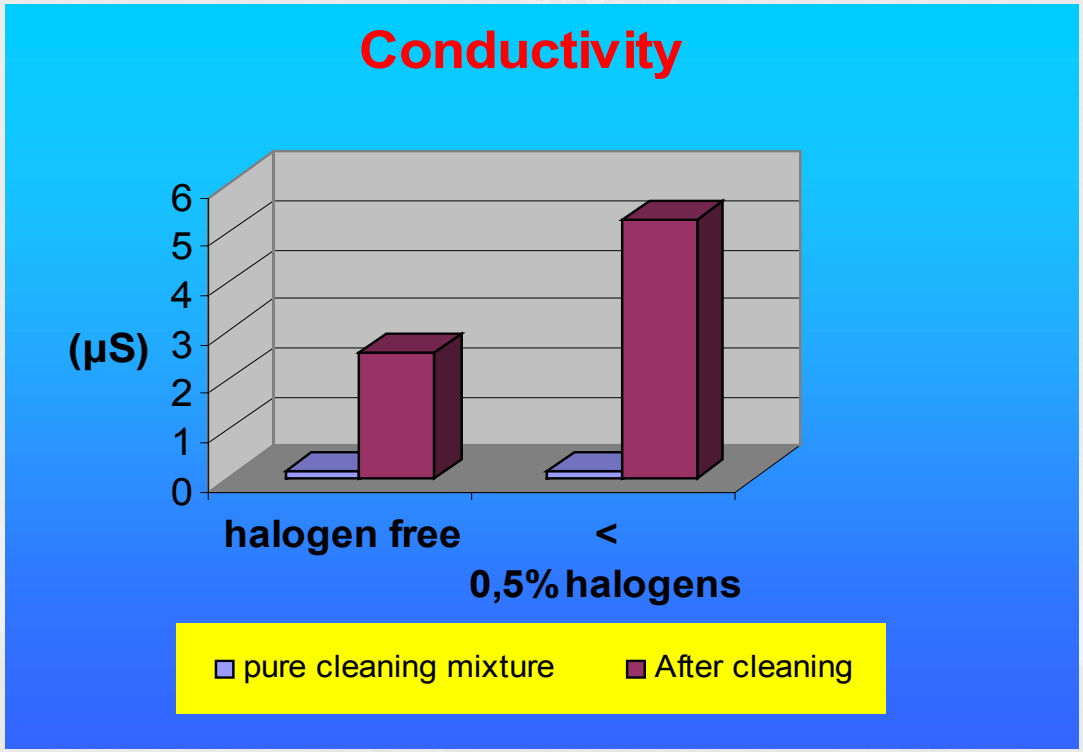
| Metal salt | Chemical designation | Solubility in cold water (g/100cc) |
|---|---|---|
| Lead chloride | $PbCl_2$ | 0,99 |
| Copper chloride | $CuCl_2$ | 70,6 |
| Silver chloride | AgCl | $89x10^{-6}$ |
| Tin chloride | $SnCl_2$ | 83,9 |

*water solubility of the metal salts*

- Water solubility is an indicator for corrosion sensitivity
- Increased tin content will have the biggest influence
- SnAgCu-salts about 50% more water soluble SnPb-salts

# Halogen free

## The electrical conductivity of lead free solder paste residues

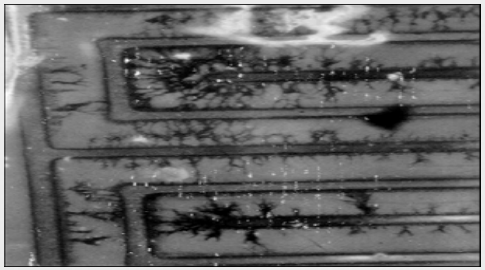



*Conductivity of lead free solder paste residues after soldering with and without halogens*

The conductivity values for the halogen containing solder paste were clearly higher.


# Halogen free

*Corrosion*



## How to predict?

- Electro migration or corrosion is very dependent on the atmosphere in which the electronic unit is working.

- Frequency of usage is a very important parameter : residue fatigue/residue cracking.

- SIR-tests and electro migration tests are not always able to predict this phenomenon as they work with a stable T° and R.H.

- The only safe way is to go absolutely halogen free


# Halogen free

## What is absolutely halogen free?

- Not so easy to recognize a halogen free product on the market
- IPC J-STD-004A (2004) still allows a halogen content of 0.05% halogens for a ´L0`
- EN 61190-1-2 (2002) allows 0.01% halogens for a ´L0`
- No easy, accurate test method available
- One will have to rely on the information that is provided by the producer.


# Halogen free

Interflux decided to go for **absolutely halogen free** chemistry for all product types for **lead free soldering**

- Solder paste : Delphine Series
- Flux: PacIFic series, IF2005C, IF3006
- Solder wire : IF14