

## Printed Circuit Boards

### OXIDES

TIN - LEAD OXIDATION

FUNDAMENTALS...

The Principle reason Aluminum wiring has been outlawed in home wiring is due to the numerous house fires. These fires were caused by heat generated by a resistor know as aluminum oxide.

These precipitated or formed oxides between individual conductors act as an insulator or more evidently they actually become a resistor. {(Resistor - The reciprocal of conductor.)(Resistor- something that resists or impedes the flow of electrons)} The by-product of resistance is heat.

According to the Werst Handbook of Chemistry and Physics 55 Pb (Lead) starts the precipitation (forming) of in-organic oxide Molecules at 69°F and 59%rh, Sn (Tin) precipitates in-organic molecules at 75°F and 80%rh. These are rough calculations since it is a heat conversion from degrees in Kelvin.

According to Webster's dictionary, every element has an oxidation number. = to the degree of or potential for oxidation. I do not know what the numbers are for tin and lead SN/PB nor have I been able to locate these. But nearly all elements may be attacked by oxygen; however Gold being one that highly resists the Oxidation process.

DEF: Oxidation- is any process which increases the proportion of oxygen or acid-forming element or radical in a compound.

DEF: Oxide- A binary compound of oxygen with an element or radical.

Consider the die-electric constant of lead acetate is 2.6 but lead monoxide is 25.9

Bottom line: Due to tin /lead oxidation the use of passive contacts on these surfaces should be avoided, Unless you have total control over temperature, humidity and free oxygen molecules. In non-extreme conditions Gold is a good substitute for a passive contact areas. In extreme conditions, due to \*\*\*inter-metallics forming between the copper and gold it is generally recommended that a tin/nickel over copper plate be used.

\*\*\* see NASA Briefs search for "inter-metallics forming between copper and gold solder joints" (dated I think, June 1983)