

## The use of Arsenic (As) in copper foil

### REACH Initiative on Arsenic

There are several misconceptions regarding the use of Arsenic (As) in copper foil applications, as it pertains to the ever changing EU/REACH regulations. REACH aims to limit occupational exposure of Arsenic metal (As) and Arsenic Trichloride (AsCl<sub>3</sub>). This legislation is making it difficult to use arsenic compounds in the manufacturing of copper foil, ultimately banning the purchase of arsenic within the EU altogether. However, there is no strict restriction on the use of articles containing arsenic metals. According the Arsenic Consortium (<http://www.as-consortium.eu/>) articles imported by EU members can contain ≤0.1% arsenic.

### The use of Arsenic in Copper

Arsenic is used in many “anti-tarnish” coatings used to prevent the oxidation and discoloration of the treated copper surface. Additionally, the arsenic assists in preserving the treated copper during chemical attack from either the lamination process, or subsequent PCB chemical processing.

The use of arsenic in “anti-tarnish” treatments began specifically to prevent both short term & long term negative effects of Cu interaction with brominated epoxy resins and other curing agents used in laminate/PCB manufacture. For example:

- Amine compounds in epoxy interacting with Cu resulting in measling and/or staining of the laminate surface
- Brominated flame retardants which may interact with Cu resulting in surface staining and/or bond strength decrease (short term & long term)

Copper foil treatments use added “barrier layers” to prevent the direct contact of Cu with the resin. The “barrier layer” prevented the negative interactions between the resin components and copper. Common “barrier layers” were/are zinc based; either brass or zinc layer that during the lamination process will inter-diffuse with the copper treatment to form brass. In some cases other metals (Ni, Co, Sn, Mo, Sb, etc.) may be added to provide desired performance benefits. Brass/zinc type barriers layers are relatively thick and provide excellent shelf life and excellent long term bonding performance.

PCB etchants and processing chemicals are very aggressive and may preferentially attack the zinc component of the barrier layer. De-zincification of brass alloys with chlorides & mineral acids is well known in metallurgy. The most common and effective way to prevent de-zincification, thereby improving the corrosion resistance of brass alloys is to add arsenic to the brass alloy. A little bit of arsenic goes a long way to improve the chemical corrosion resistance.

**Safe levels of Arsenic**

The Denkai America foils that do use arsenic in the “anti-tarnish” coating only contain a trace amount of the substance,  $\leq 0.05\%$ , which is well below the EU threshold of  $\leq 0.1\%$ . Our copper foils are tested annual by a third party for compliance with all current REACH and RoHS directives; these reports are available upon request.

**Safe use of Arsenic at Denkai America**

The safety of Denkai America employees is our number one priority. When using Arsenic, or any other hazardous chemicals, we take pride in exceeding state and federal guidelines for employee training, protection, and exposure monitoring. While Arsenic can be a toxic substance, with responsible use, the incorporation into our products is done safely for the benefit to our customer.

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