

# zinc whisker induced failures in electronic systems

*the recent experience of a major financial company highlights the fact that zinc whiskers present increasing risks to the 'health' of electrical installations*

High failure rates were encountered on PCBs and power supplies within data processing equipment in a large data processing centre in North East England. The problem was traced to small metallic particles of zinc being deposited on the PCBs and causing inter-track conduction. The source of the zinc was the galvanised coating on the underside of the raised floor tiles. Examination found that zinc whiskers were present and were being carried in the airflow from the pressurised under floor plenum into the intake vents of the equipment.

The failures experienced had a serious financial impact upon the business and seriously compromised confidence in the ability of the Centre to support the corporate requirements.

## what are zinc whiskers?

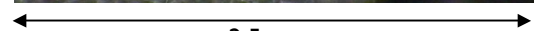
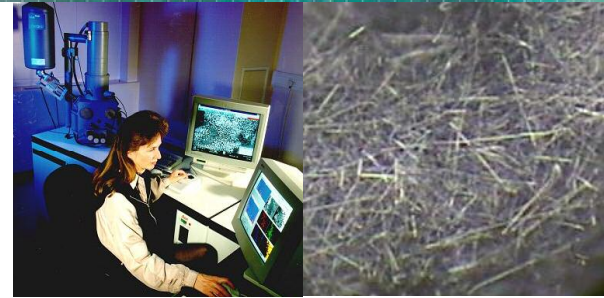
Zinc whiskers 'grow' from metal surfaces that have been coated with zinc to help protect them from corrosion. Whisker growth appears to be limited to electroplated surfaces, rather than those that have been hot-dipped or sprayed, and is caused by internal stresses incurred during the plating process. Fine zinc filaments, normally only a few microns in width, but of several hundred microns to a few mm in length, develop from the plated surface. A mass of zinc whiskers removed from a computer installation is shown in image 1.

Although zinc whiskers have been found on a wide range of surfaces, access floor tiles are of particular concern, as they have large surface areas, and are often moved during day-to-day maintenance. The zinc whiskers are fragile and can easily be broken off the tile - some whiskers may then get into the supply airflow and be carried to the hardware via the ducting beneath the flooring, as in the above case.

Tin and tin alloy whiskers also cause problems in electronics but are not discussed here.

## identifying zinc whiskers

ERA can detect the presence of zinc whiskers in samples of dust taken from data processing installations by using a combination of imaging and analysis techniques.



2.5 mm  
1. Massed zinc whiskers

Image 2 is a Scanning Electron Microscope (SEM) image of mixed particulates from a dust sample collected from a computer room. Energy Dispersive X-ray (EDX) analysis can be used for fast identification of zinc within the sample - by selection of a particular EDX energy range, zinc can be imaged as orange within a composite 'Cameo' image of the same sample area, as shown in image 3. A quick glance shows that zinc is present in both particle and whisker form. Fibres of glass or mineral composition, are coloured blue / green. Using this technique it is possible to see the zinc whiskers at very low magnification, as shown in image 3. Spot checks on individual fibres are made to check the overall analysis.

## zinc whisker problems on the increase

The consequences of a long zinc whisker getting into the wrong place can be catastrophic. These conductive whiskers have posed a threat to the electronics for many years but older electronic designs with larger gaps between components and pins were less likely to be compromised. As circuitry has evolved it has become more closely packed and operating voltages are lower. The whiskers can be long enough to bridge many gaps between pins of components in current installations and the ever denser geometry of newer technologies means that this problem is likely to increase.

### ERA can help by:

- > Determining whether or not zinc whiskers are present in dust samples taken from regions within an installation.
- > Recommending corrective action in conjunction with acknowledged experts in the field of computer installations, such as Worldwide Environmental Services. It may be necessary to replace all floor tiles - if some are inaccessible, these may have to be screened or encapsulated in some way.

Further information regarding zinc whiskers and their effects on computer installations can be found at [http://www.wes.net/crs-zinc\\_whisker\\_detail.htm](http://www.wes.net/crs-zinc_whisker_detail.htm)

### further reading

ERA publishes a number of helpful publications in this area:

- Reliability of Electronics Handbook
- Contacts and Connectors
- Soldering and Solderability

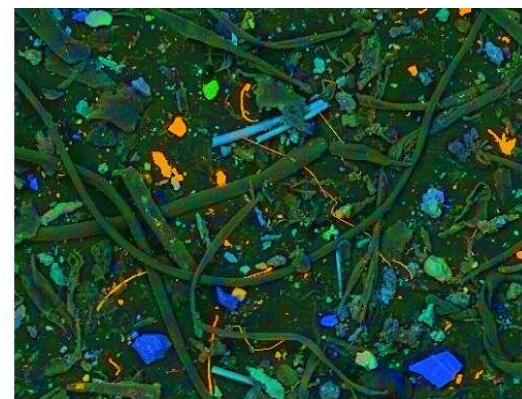
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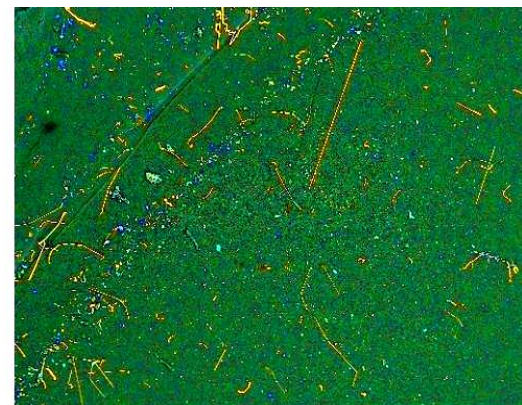
The Reliability and Failure Analysis Group is Europe's leading consultancy for impartial electronic, mechanical and electrical engineering reliability & failure investigation.



2. Dust sample containing mixed particulates



3. Same area as above, 'Cameo' image showing zinc as orange



4. 'Cameo' image identifying zinc whiskers (orange) at low magnification

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