

**WHISKERMIT: Manufacturing and in-service tin whisker mitigation strategies for high value electronics**

Geoff Wilcox, Loughborough University

Tin (Sn)-based metal coatings, such as those produced by electroplating, are widely used in electronics manufacture as solderable surfaces and as general protection to guard against corrosion and oxidation of underlying metal surfaces. Tin (along with zinc and cadmium) can produce hair-like growths often exceeding 5 mm in length. The propensity for these growths to cause inherent shorting failures in electronics, particularly with very small inter-component spacings, is very marked. In the past the capacity of electroplated tin coatings to produce tin whiskers was significantly reduced by the alloying of tin with in excess of 3% lead (Pb). Recent environmental laws banning the use of lead in electronics has removed this safeguard. Consequently, the occurrence and threat posed by tin whiskers has risen to worrying levels, particularly where manufacturers have used bright tin finishes which are renowned for tin whisker formation.

The WHISKERMIT project will examine tin whisker mitigation through a dual approach. Firstly the project will characterise a commercial bright tin electroplating electrolyte to use as a baseline onto which modifications in terms of compressive stress-relieving additions can be made. These additions will be in the form of co-deposited nano-particulates which have been shown to reduce internal stresses in other composite electroplating systems. Accelerated whisker testing will be undertaken using in-house and industrial partner facilities to measure whisker reduction. The second phase of the project will formulate a new whisker mitigating polymeric coating through structural and compositional modification. This will be achieved by examining how whiskers interact with known polymer films and which chemical formats and physical properties produce true reductions in whisker emergence through such films. Data from these trials will be utilised to produce novel nanostructured polymer coatings (NNPCs) with inherent properties to stem tin whisker growth. Their efficacy in terms of tin whisker mitigation will be examined via accelerated environmental testing. The duality of a combined modified tin electroplating system and a NNPC will also be assessed.