

# Bachelor thesis / ARL / Master thesis

Whisker formation and growth in lead-free solder alloys



LETTERSS Project

Lead-free Transition for the European Space Sector



## Problem

With the potential application of the Restriction of Hazardous Substances (RoHS) legislation to the aerospace industry, lead-free finishes cannot be avoided in electrical, electronic and electromechanical parts. Besides the difficulties of finding a mechanically reliable lead-free solder, metal whiskers (Figure 1) are of concern for the European Space Sector. These crystalline filaments can grow out of the surface up to some millimetres and may lead to short circuits or other electrical failures in electronic components. In the context of a constant miniaturisation trend in complex electronic assemblies, it is of utmost interest to prevent malfunction risks from whiskers.

The long-term goals of this project are to advance the understanding of the interactions between factors influencing the whisker phenomenon, to provide guidelines and to propose whisker acceleration test conditions for future characterization and mitigation procedures.

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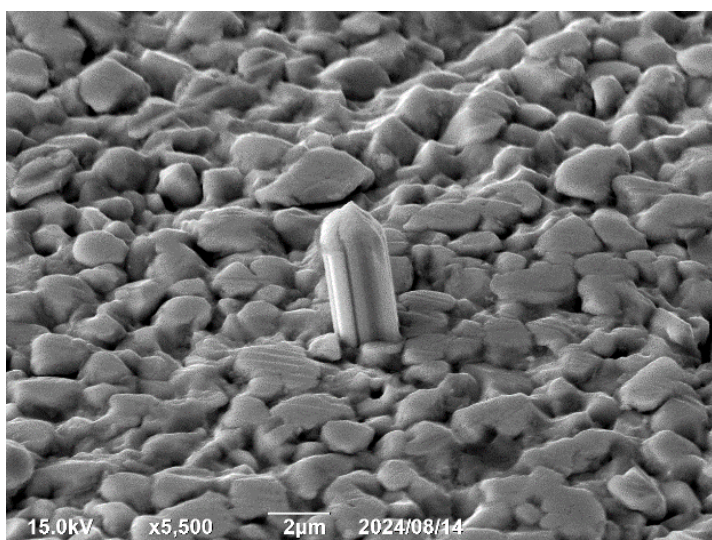


Figure 1: SEM image of tin whisker

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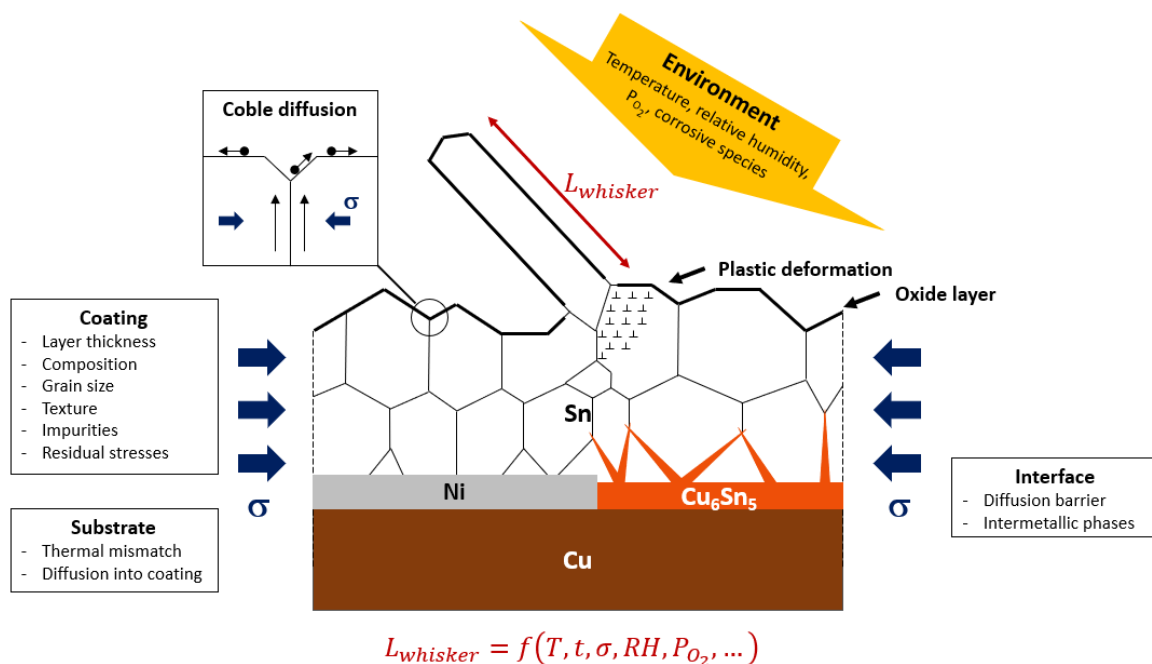
## Tasks

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The aim of this work is to analyse the interplay between influencing factors (Figure 2) on whisker formation and growth rate. It is proposed to employ model experiments in which parameters can be changed independently of each other to replicate conditions under which the highest growth rates of whiskers are found.

Following tasks are involved:

- Literature research on the state of the art of whisker nucleation and growth
- Experimental investigation of influencing factors (separate & combined)
- Identification of driving factors
- Creation / management of an internal database
- Correlation between findings under lab conditions and real components
- Representation, critical analysis and discussion of results
- Reporting



**Figure 2:** Schematic representation of factors influencing whisker growth in Sn coating

**Supervisor:** Dr.-Ing. Guillaume Meyer (L2 | 01 56)

Prof. Dr.-Ing. K. Durst

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## German Title

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Whiskerbildung und -wachstum in bleifreien Lotlegierungen

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