SchAlbaDick - Correlation of shear test results and reliability of fine crystalline aluminum thick wire bond contacts

Thick wire bonding is used as the basic technology for connecting power-electronic components, modules and systems. Newly developed Al-based wire materials lead to significant increased stability in terms of thermal, corrosive or mechanical loading. This leads to rapid popularization of the new wires but also to many questions concerning the quality and reliability assessment.

The intention of this project is the investigation of the new wire materials answering the question, how can shear test results be correlated to the microstructure and mechanical properties and what conclusions are provided for assessing the bond quality and contact reliability. By systematic mechanical tests and microstructural analyzes a fundamental scientific knowledge of the deformation processes during the shear test in function of wire and contact material should be acquired for initial state after bonding as well as after several reliability tests (HTS, TCT, APC).

The shear test is the acknowledged and established method for evaluation of the contact quality between Al-wedge and bond metallization. The up to date specification of shear test results are based on values defined using pure aluminum standard wire. The new materials vary significantly in mechanical and microstructural properties to pure aluminum wires. Thus, the specification has to be revised for an objective evaluation of the bond contact quality.

The development of finite element models for the wire bonding process and the shear test should allow to simulate the influences of material properties and process parameters for estimating the contact quality and reliability behavior with reduced experimental effort.

In form of defined criteria or formulated evaluation recommendations, the knowledge of the project can subsequently be transferred into industrial quality management systems and implemented into guidelines or standards.

Short view

Mission: How can shear test results be correlated to the microstructure and mechanical properties and what conclusions are provided for assessing the bond quality and contact reliability? How can these results be correlated with the reliability at passive and active tests.

Approach: A fundamental scientific knowledge of the deformation processes during the shear test in function of wire and contact material should be acquired by systematic mechanical tests and microstructural analyzes for initial state after bonding as well as after several reliability tests.

Benefit: Producing enterprises, supplier or OEM with thick-wire-application can use the results of the project in form of defined criteria or formulated evaluation recommendations and transfer them into industrial quality management systems guidelines or standards.