

Down to the Wire

Failure Analysis Through the Cartesian Coordinate System

Florian Seibold

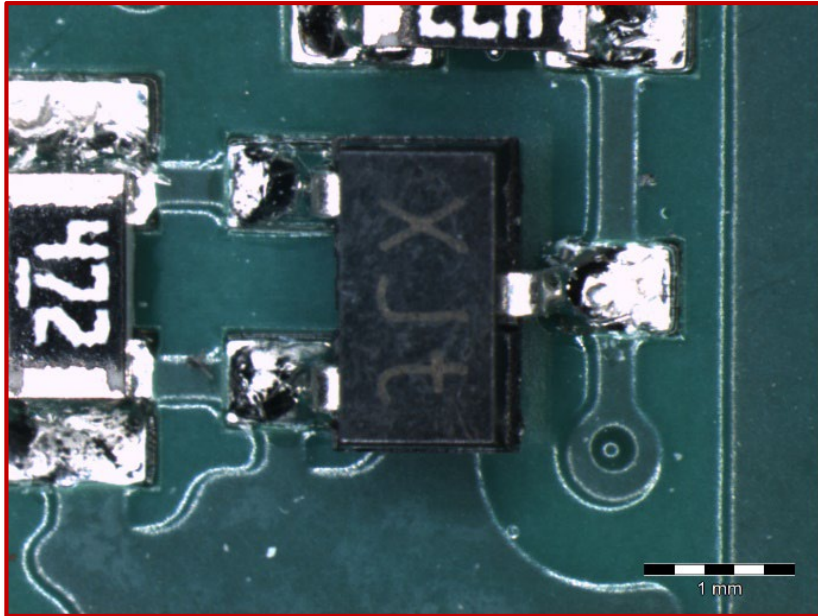
Engineer – Failure & Technology Analysis

Jürgen Gruber

Manager Failure- and Technology Analysis

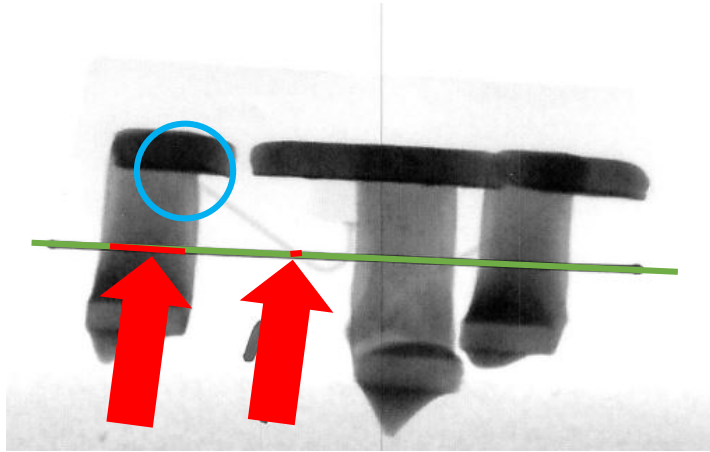
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Overview



- ❑ Field failure in automotive application
- ❑ Malfunction on board level
- ❑ Failure could be explained with an open gate connection
- ❑ Only one failing part was available
- ❑ Desoldered after drying

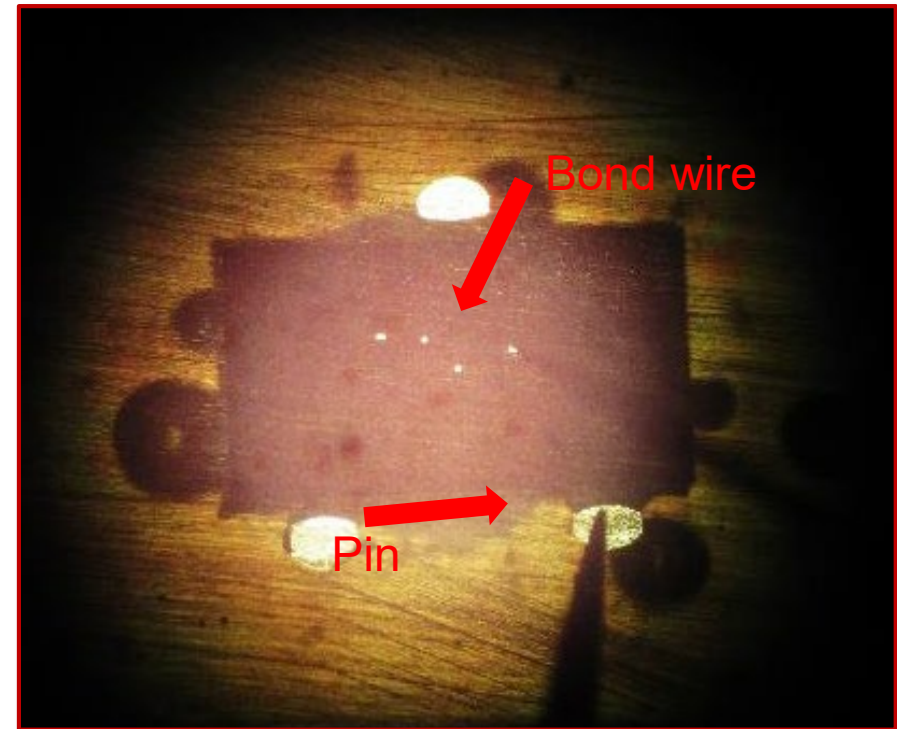
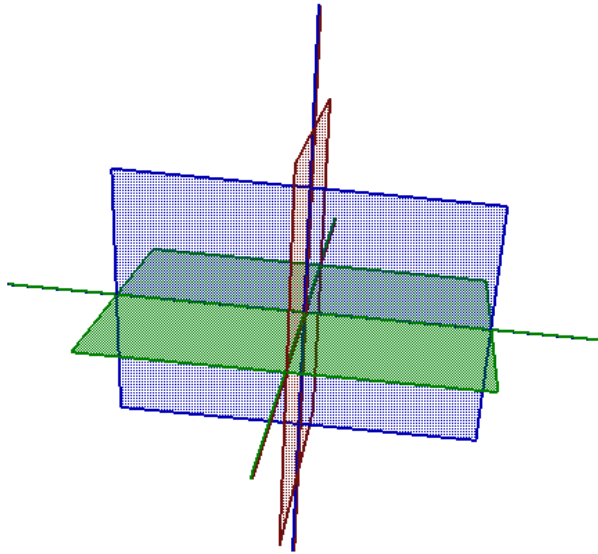
Failure Analysis – Y Cross Section



Flat grinding through PCB to interrupt bond loop.

Resistance measurement with needle prober.

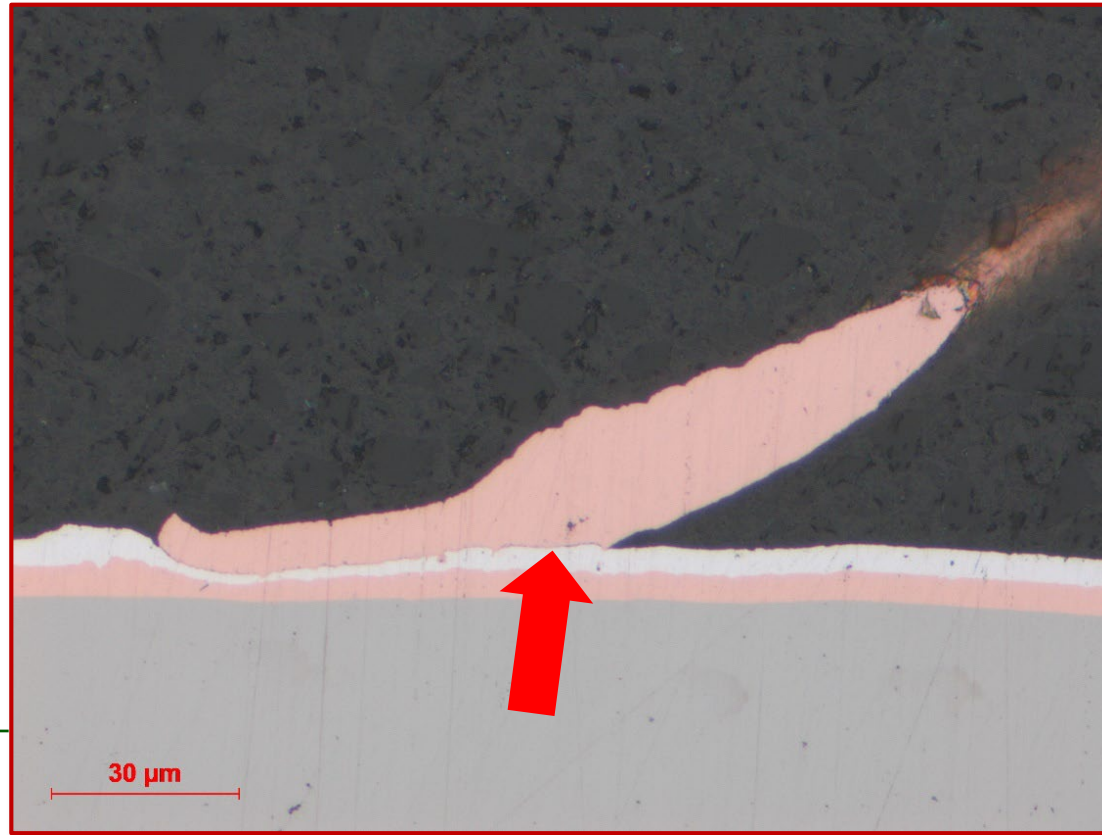
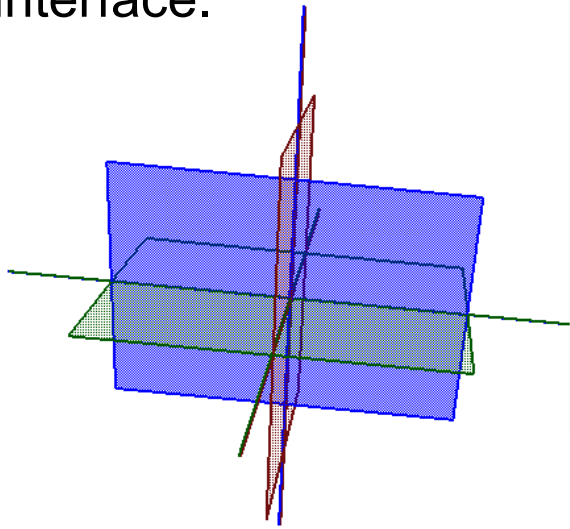
This confirmed an open connection on the stitch bond side.



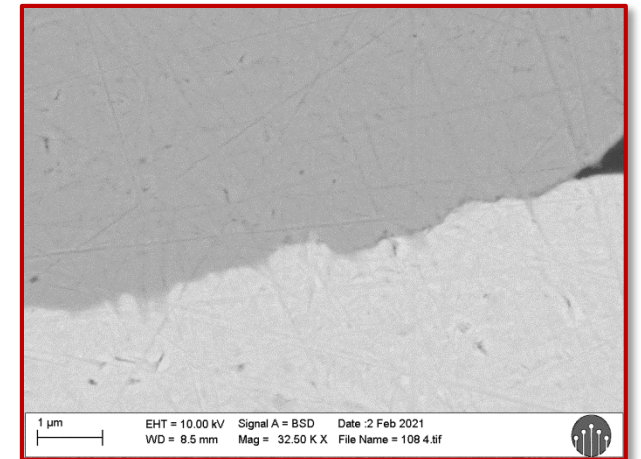
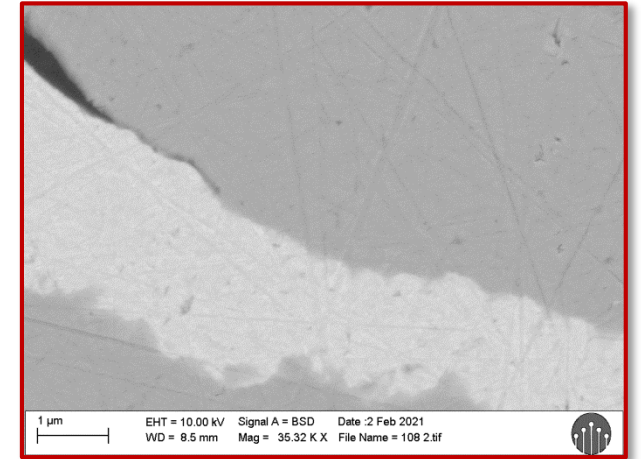
Gate connection: 11.93 M Ω

Failure Analysis – Z Cross Section

Cross sectioning through stitch bond. Showed signs of a black line at Cu-Ag interface.



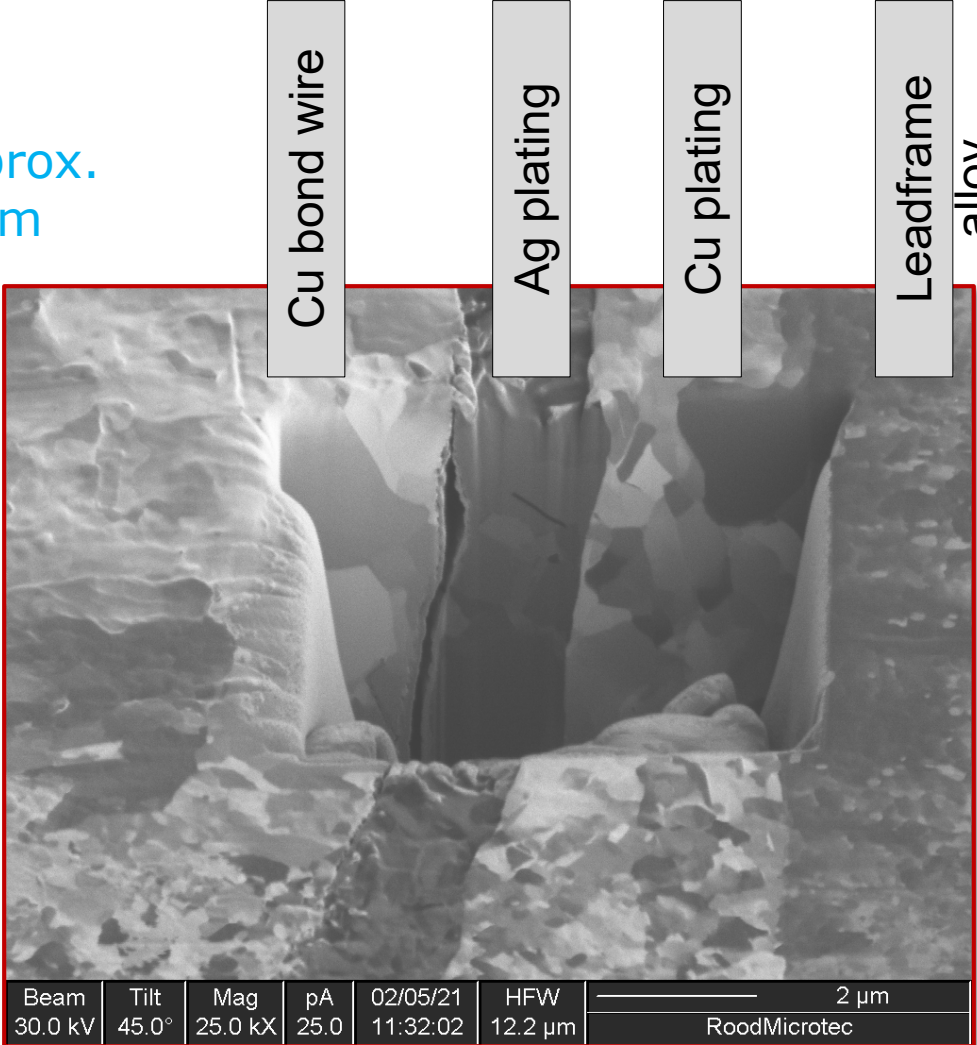
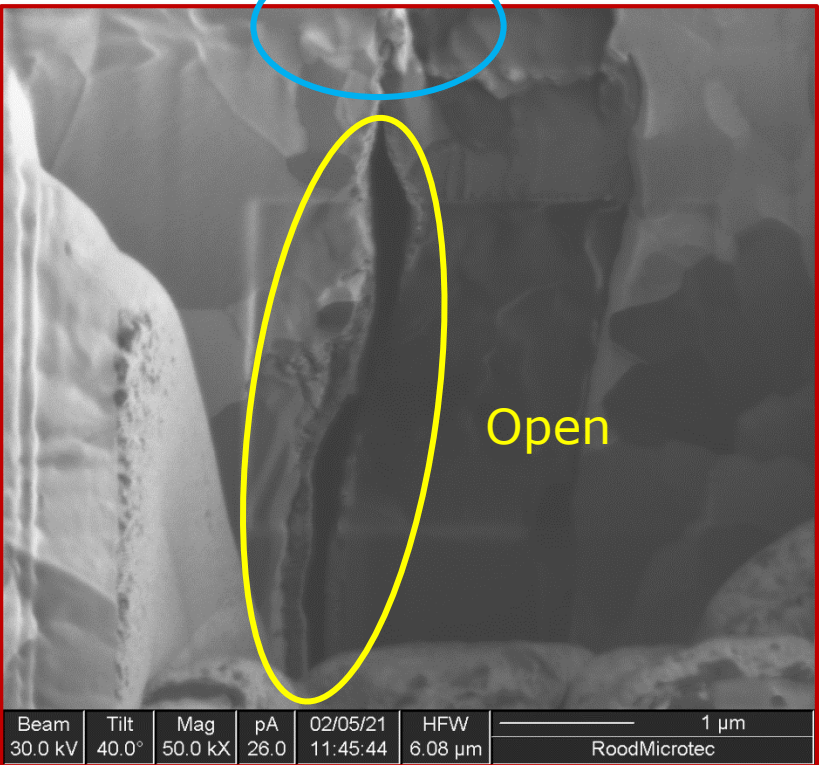
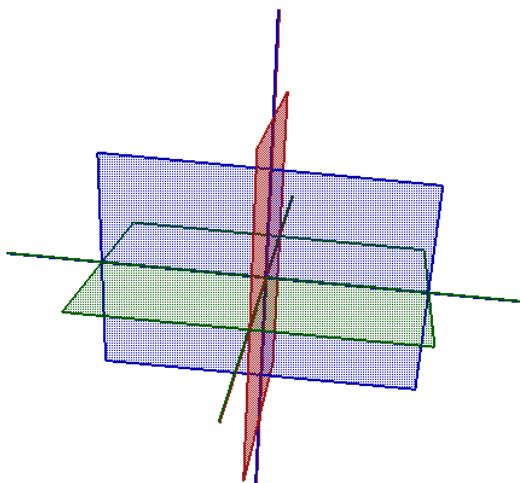
But not recognizable in SEM.



Failure Analysis – X Cross Section

Focus Ion Beam cross section through interface revealed an open connection covered by a smeared surface.

Smearing approx.
0.5 – 1.0 μm



Failure Analysis – Conclusions

- ❑ The Y metallographic cross section localized an open gate connection.
- ❑ The Z metallographic cross section showed an unclear black line at Ag-Cu.
- ❑ The X FIB cross section confirmed the open connection and a smearing on the surface.
- ❑ Machine polishing can induce a smearing of approx. 0.5 – 1.0 µm.
- ❑ FIB cross section have become increasingly necessary to confirm such open bond contacts.
- ❑ Automotive failure analysis often require extra steps, both in between and at the end to conclusively confirm the physical failure without losing it, especially when only one failed part is available.

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Partner
in Business!

Contact us

info@roodmicrotec.com

Tel: +49 9081 804-0

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www.roodmicrotec.com

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