Impact of Low Pressure Molding on Solder Joints

Henkel Electronics

Excellence is our Passion

Contents

1. Problem Statement and Objective
2. Evaluation Procedure
3. Results
4. Conclusions

Problem Statement and Objective

- Two different Printed Circuit Board Assembly (PCBA) modules from a customer were encapsulated using TECHNOMELT®.
- The customer has requested Henkel to document microstructural changes (if any) to the solder joints resulting from TECHNOMELT® process.

Evaluation Procedure

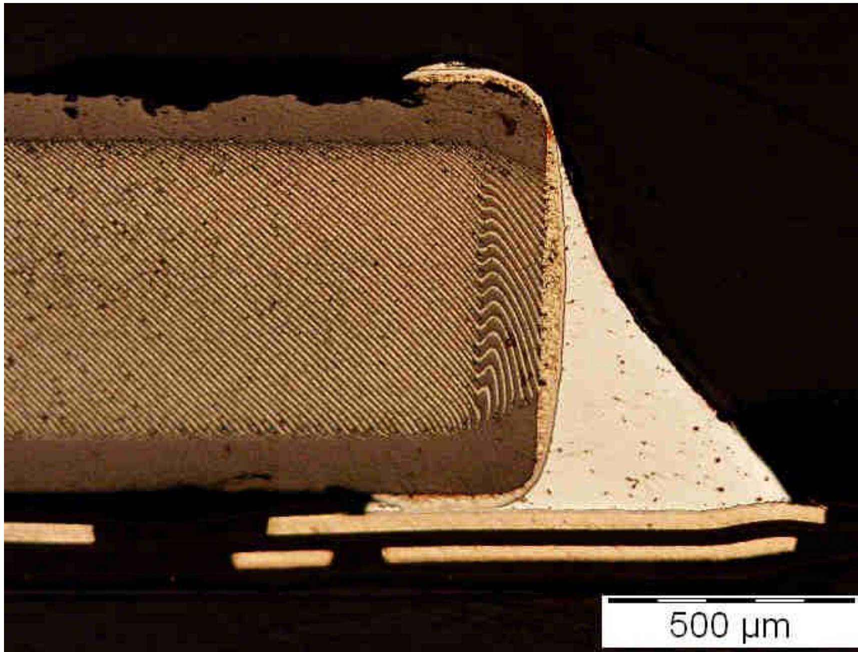
- Two modules (module 1 and module 2) were encapsulated using TECHNOMELT® along with two similar un-encapsulated modules were submitted for evaluation.
- All four modules were first enclosed in an epoxy to provide structural stability during singulation and cross sectioning of solder joints.
- Similar capacitor locations on modules with and without TECHNOMELT® were singulated from the four modules, potted in epoxy and micro-sectioned for optical microscopy.
  - Cross-sectioning procedure included rough grinding through 5,000 grit emery paper, followed by fine polishing through 0.05µm Al_2O_3 slurry and colloidal Silica.
  - Optical microscopy was carried out using Olympus BX51 equipped with Olympus MicroSuite image analysis software.

Henkel

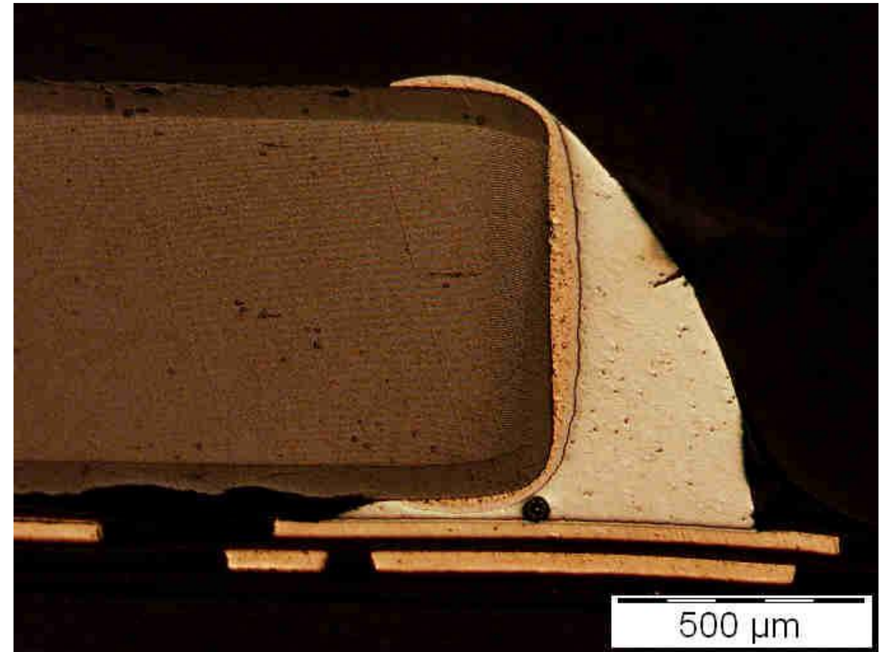
Results

- Comparison of solder fillets on capacitors from similar locations on the encapsulated and un-encapsulated modules show good fillet formations and no discernible difference in the solder joints.

MODULE 1



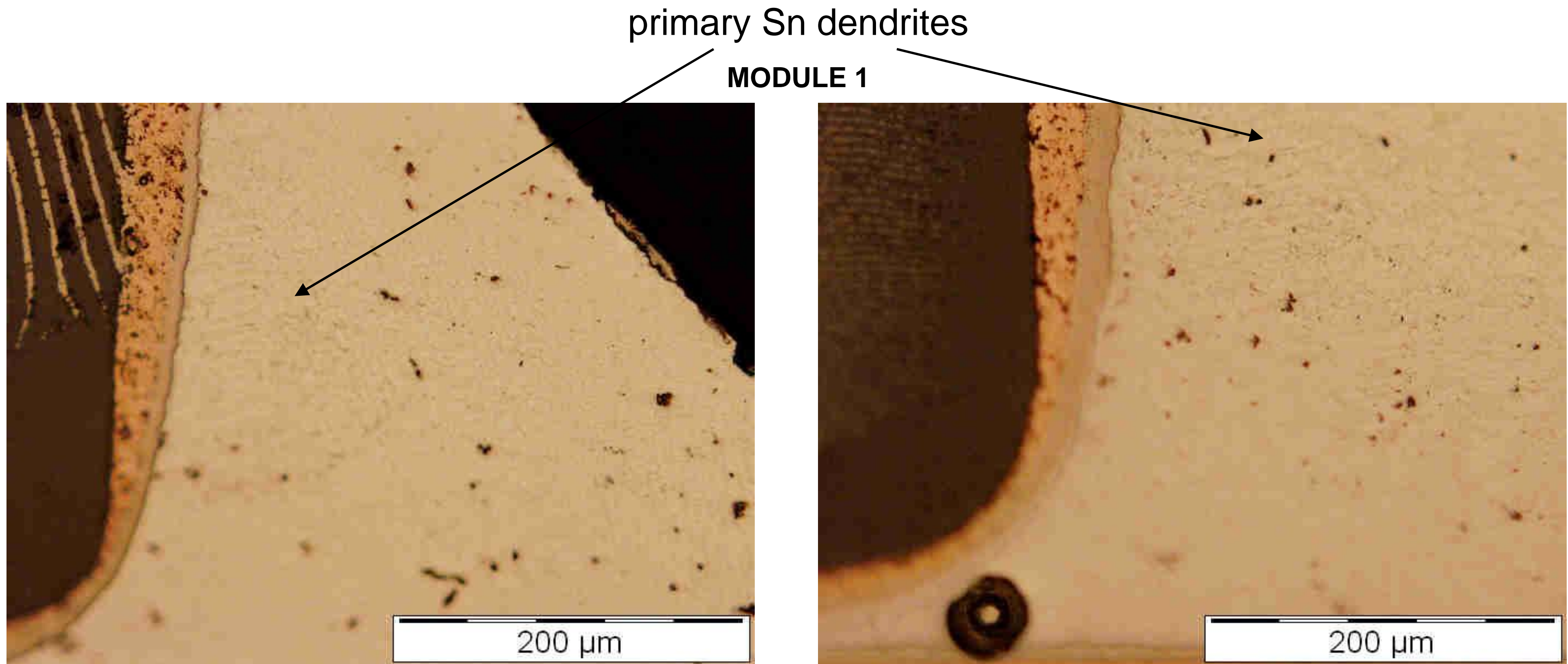
Encapsulated in TECHNOMELT®



Un-encapsulated

Results (continued…)

- Comparison of bulk solder on capacitors from similar locations on encapsulated and un-encapsulated modules show similar microstructure typical of a SAC solder.



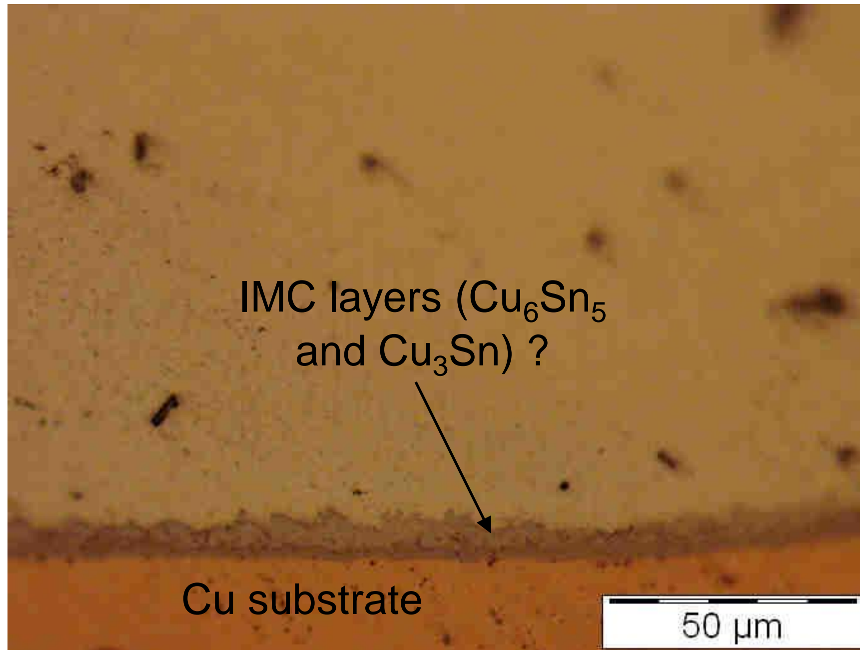
Encapsulated in TECHNOMELT®

Un-encapsulated

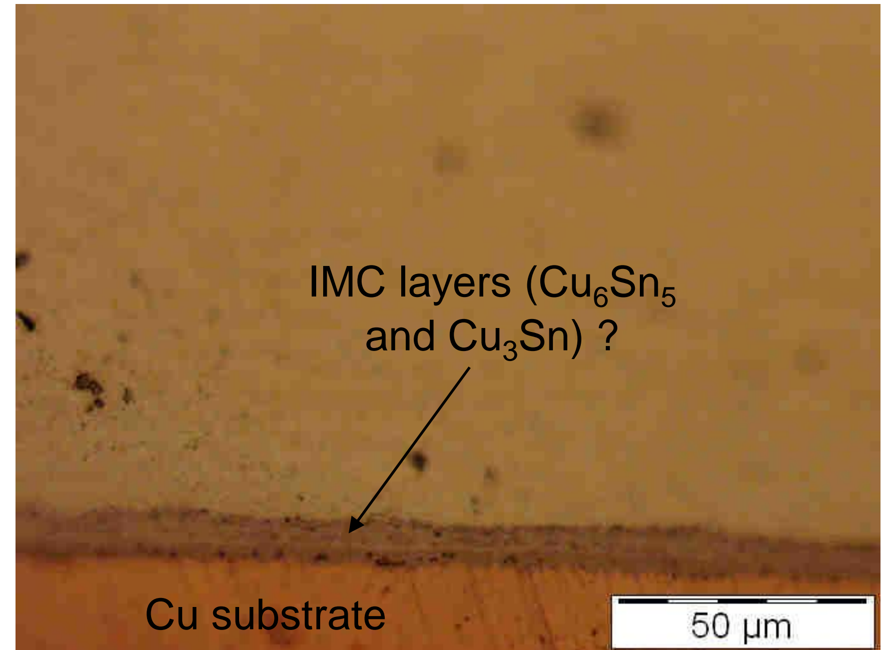
Results (continued…)

- Comparison of solder joints on capacitors from similar locations on encapsulated and un-encapsulated modules show Intermetallic Compound (IMC) layers of similar morphology and thickness on the PCBA side.

MODULE 1



Encapsulated in TECHNOMELT®

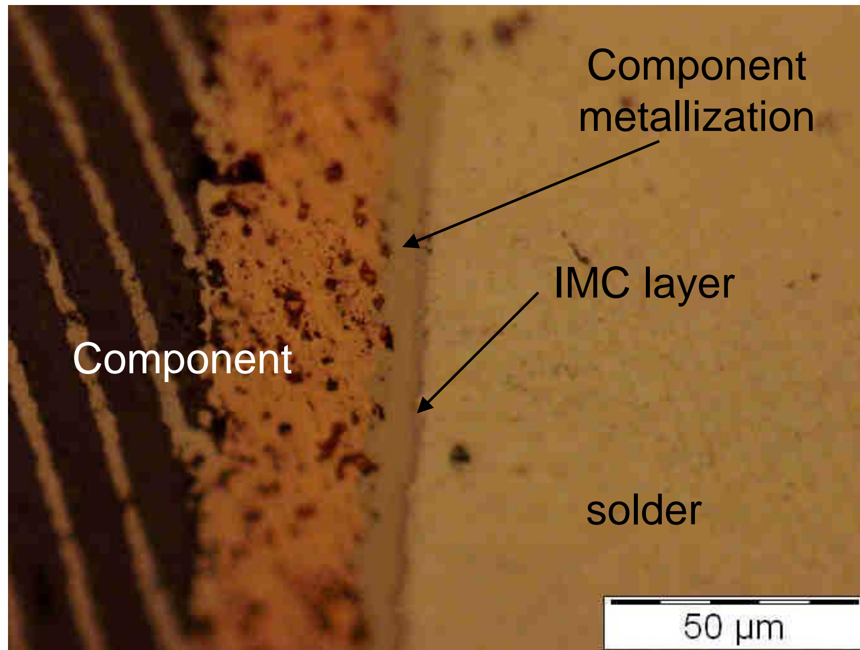


Un-encapsulated

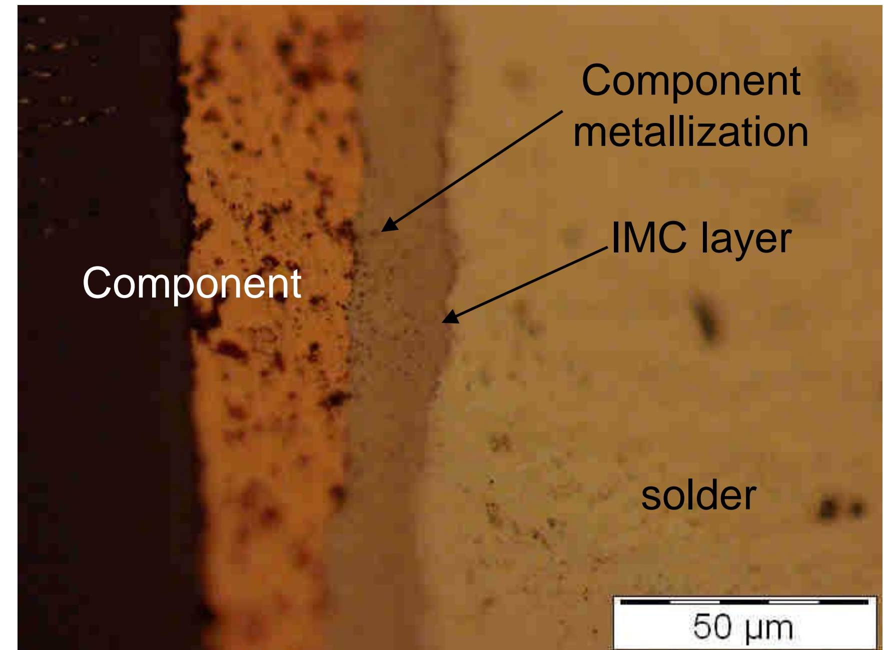
Results (continued…)

- Comparison of solder joints on capacitors from similar locations on encapsulated and un-encapsulated modules show Intermetallic Compound (IMC) layers of similar morphology and thickness on the component side.

MODULE 1



Encapsulated in TECHNOMELT®

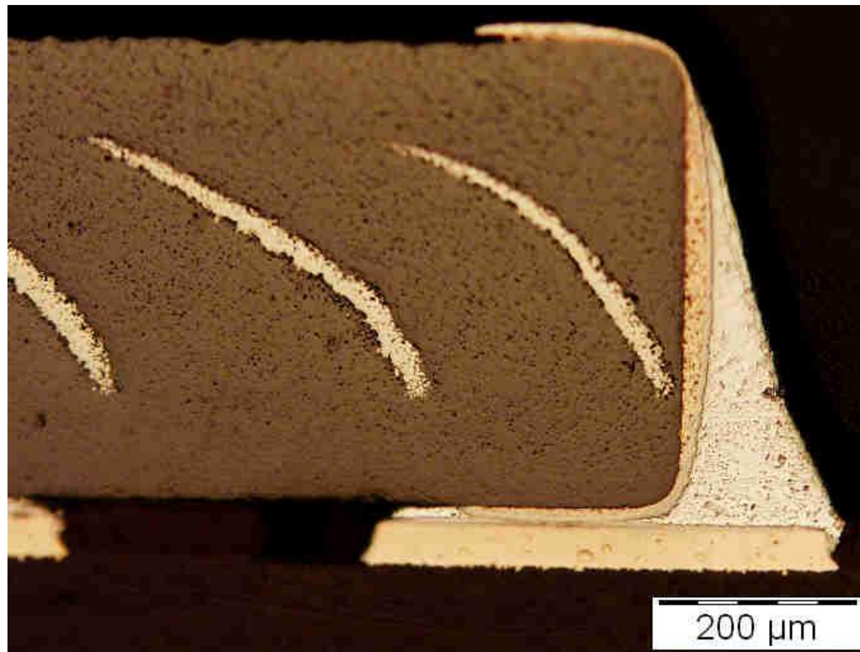


Un-encapsulated

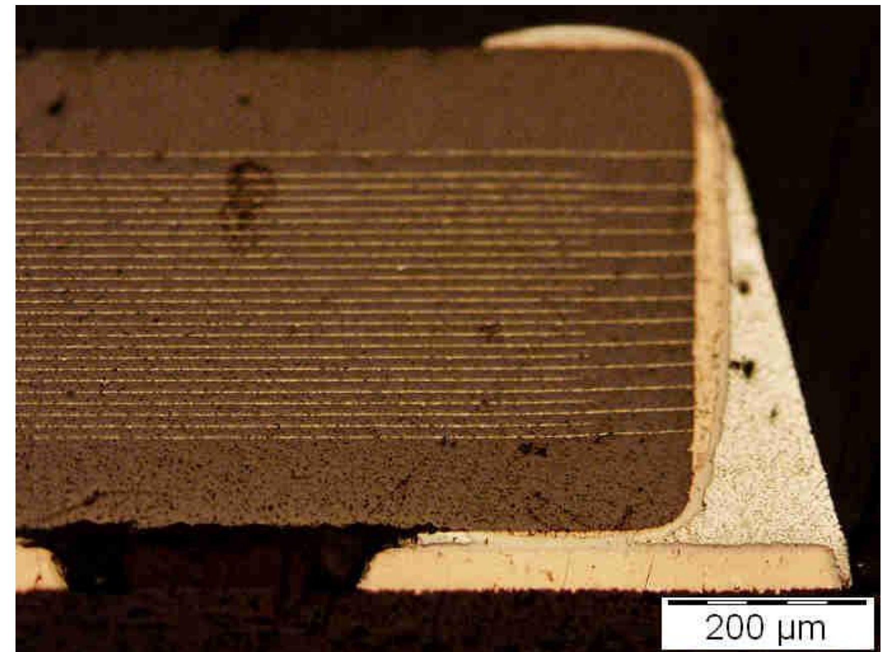
Results (continued…)

- Comparison of solder fillets on capacitors from similar locations on encapsulated and un-encapsulated modules show good fillet formations and no discernible difference in the solder joints.

MODULE 2



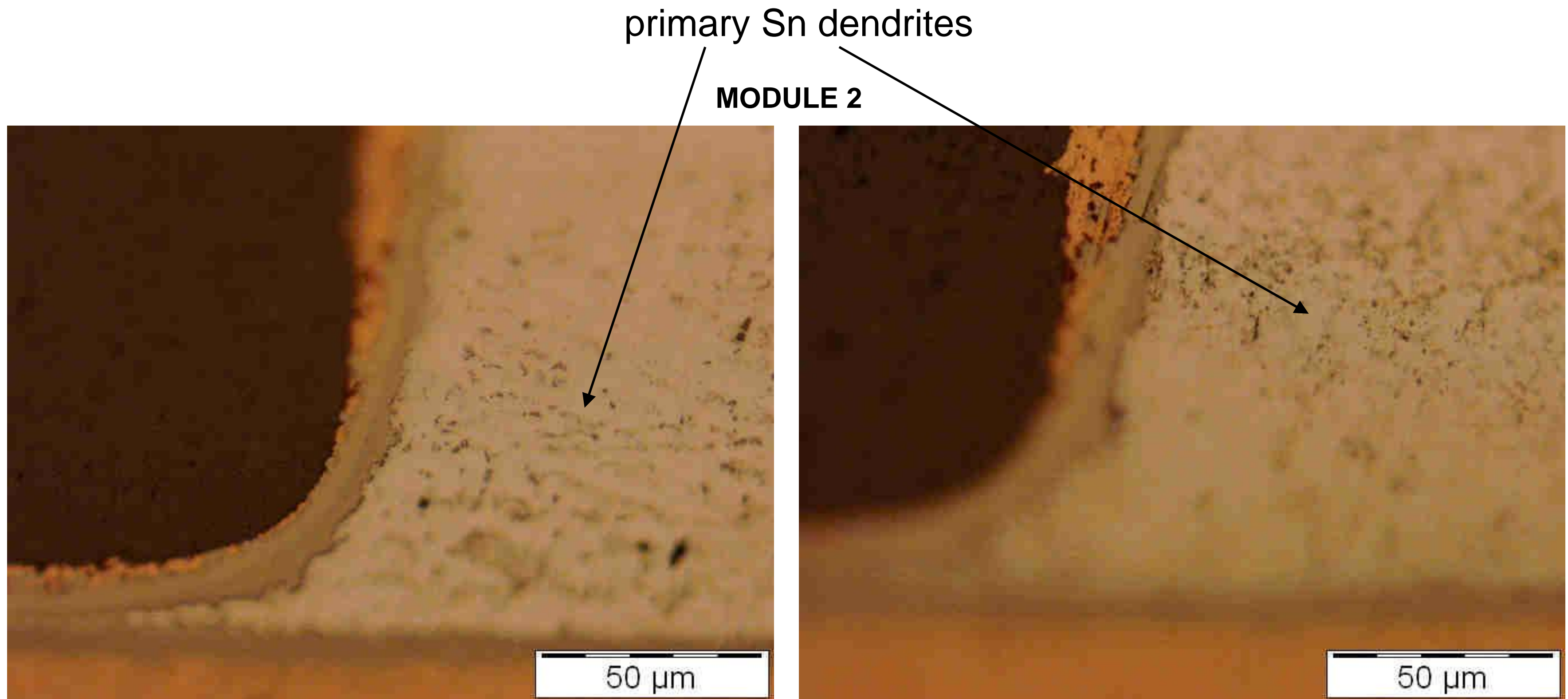
Encapsulated in TECHNOMELT®



Un-encapsulated

Results (continued…)

- Comparison of bulk solder on capacitors from similar locations on encapsulated and un-encapsulated modules show similar microstructure typical of a SAC solder.



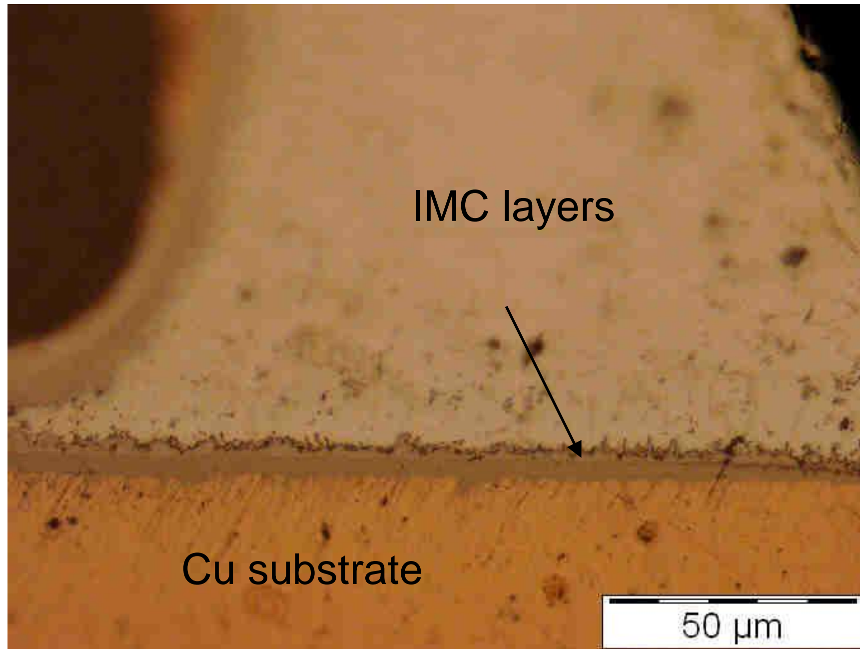
Encapsulated in TECHNOMELT®

Un-encapsulated

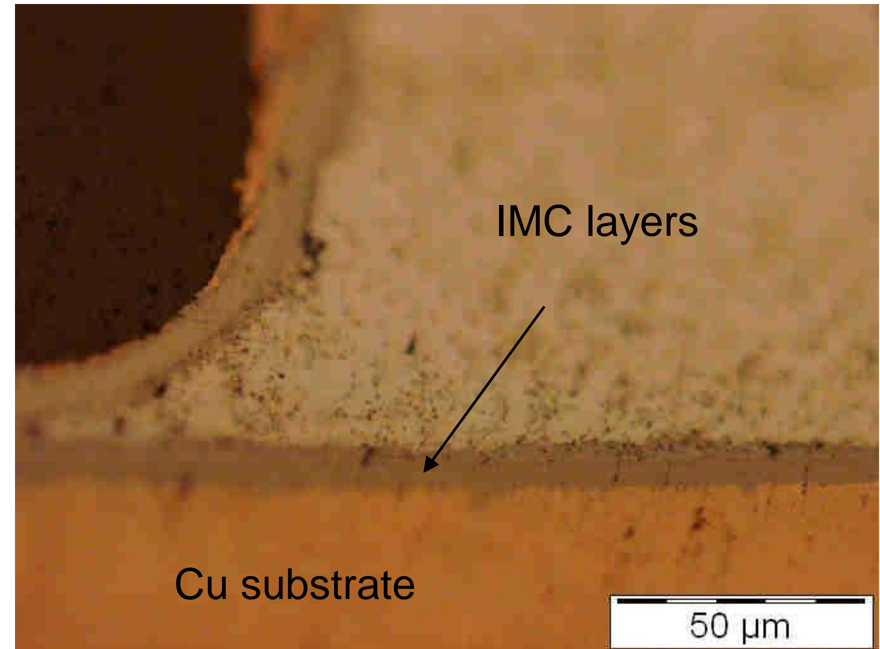
Results (continued…)

- Comparison of solder joints on capacitors from similar locations on encapsulated and un-encapsulated modules show Intermetallic Compound (IMC) layers of similar morphology and thickness on the PCBA side.

MODULE 2



Encapsulated in TECHNOMELT®

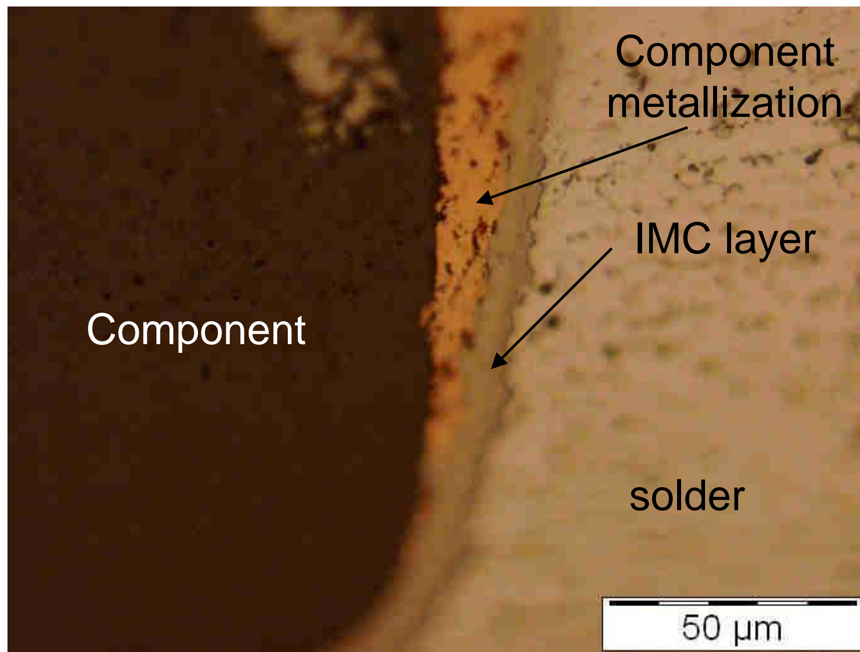


Un-encapsulated

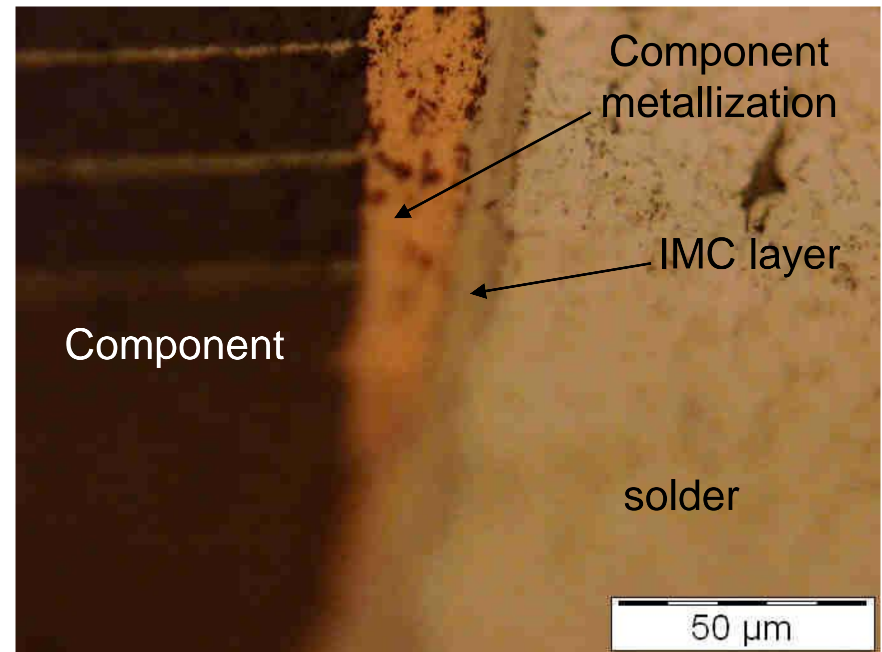
Results (continued…)

- Comparison of solder joints on capacitor from similar locations on encapsulated and un-encapsulated modules show Intermetallic Compound (IMC) layers of similar morphology and thickness on the component side.

MODULE 2



Encapsulated in TECHNOMELT®



Un-encapsulated

Conclusions

- Comparison of the cross-sectioned solder joints on the components from similar locations of un-encapsulated and TECHNOMELT® encapsulated Modules 1 and 2 show that:
  - The bulk solder microstructure is similar and is typical of a SAC solder alloy reflowed over Cu substrate
  - The intermetallic (IMC) layers at the PCB interface appear to have a scalloped morphology indicating that the IMC layer is comprised of Cu_6Sn_5 and Cu_3Sn
    - No elemental mapping was carried out to confirm the composition of IMC layer(s). Observations and nomenclature are solely based on optical microscopy and prior knowledge of published data from literature.
  - There is no difference between IMC layers on encapsulated and unencapsulated PCBAs and component side solder joints.

Conclusions

- On the modules examined, the TECHNOMELT® process has not contributed to either bulk solder joint microstructure coarsening/evolution or ripening/thickening of the intermetallic layers on the PCBA and component sides.

Thank you!