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STC ANALYTICAL LABORATORY REPORT

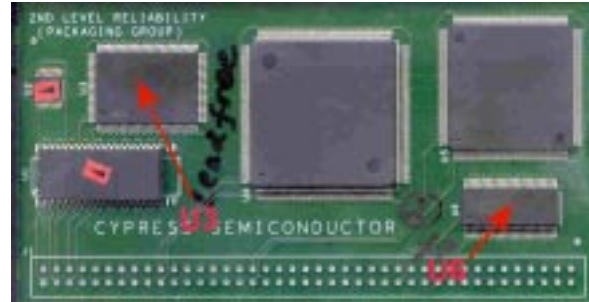
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Manager:	Alfred Kwong, Manager STC Analytical Laboratory		408-935-5805
Objective:	Provide Cross Section and Pull Test Analysis On Cypress Lead Free Test Vehicles Boards.		
Assembly:	Cypress Test Vehicle Board.		
Customer:	Cypress Semiconductor.		
Title:	Lead Free Solder Joint Evaluation.		

Originator: *Tuyen Nguyen*

Date
03/13/02

User Manager: *Alfred Kwong*

Date
03/15/02



Four Cypress Test Vehicle (TV) Boards were submitted into the FA lab for cross-sectional and pull test analysis. The above picture is the sample of the Cypress test vehicle board. U6 and U3 were chosen for cross-section and pull test (4 pins/side), respectively. The four TV boards have a HASL surface finish and are identified, as follows:

- Board 1 – Lead free solder paste with Ni/Pd/Au surface finish on component leads.
- Board 2 – Lead free solder paste with Sn/Pb surface finished leads.
- Board 3 – Sn/Pb solder paste with Sn/Pb surface finished leads.
- Board 4 – Sn/Pb solder paste with Ni/Pd/Au surface finished leads.

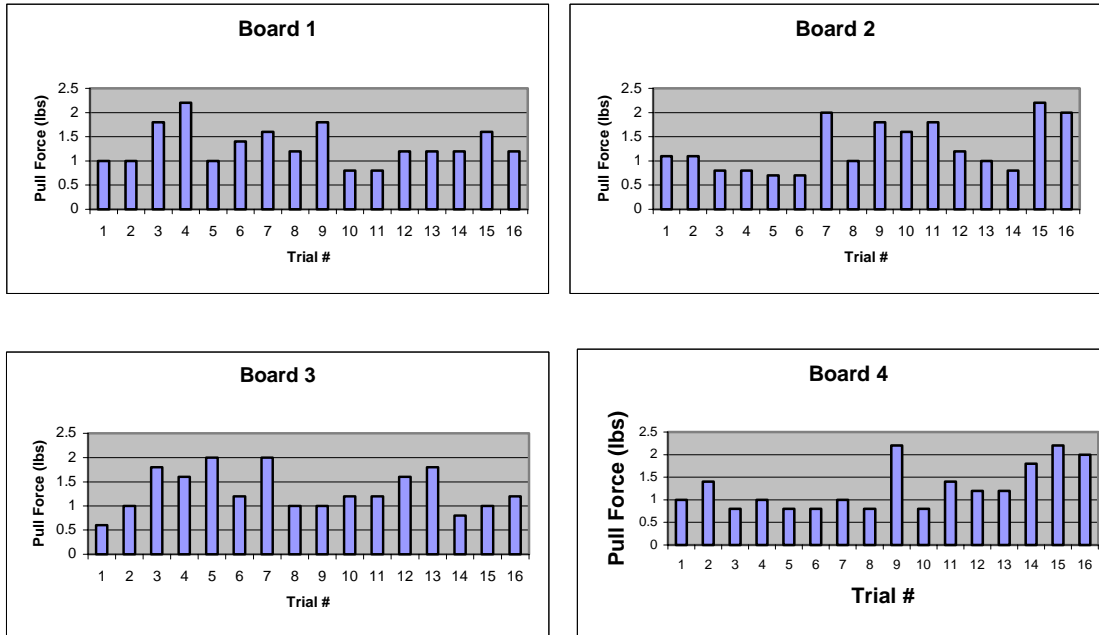
1. PULL TEST DATA RESULTS.

Four pins for each side of U3 were subjected to pull test.

Table 1 Pull Test Data - Lbs

Trial #	Board 1	Board 2	Board 3	Board 4
1	1	1.1	0.6	1
2	1	1.1	1	1.4
3	1.8	0.8	1.8	0.8
4	2.2	0.8	1.6	1
5	1	0.7	2	0.8
6	1.4	0.7	1.2	0.8
7	1.6	2	2	1
8	1.2	1	1	0.8
9	1.8	1.8	1	2.2
10	0.8	1.6	1.2	0.8
11	0.8	1.8	1.2	1.4
12	1.2	1.2	1.6	1.2
13	1.2	1	1.8	1.2
14	1.2	0.8	0.8	1.8
15	1.6	2.2	1	2.2
16	1.2	2	1.2	2
Average	1.31	1.29	1.31	1.28

Table 1 showed that the lowest and the highest pull force for board 1, board 2, board 3, and board 4 are 0.8 and 2.2 lbs, 0.7 and 2.2 lbs, 0.6 and 2 lbs, and 0.8 and 2.2 lbs, respectively.



2. CROSS-SECTION RESULTS.

2.1 BOARD 1 – Lead free solder paste with Ni/Pd/Au surface finished.



Figure 1 shows cross-sectional over view of U6 with left and right leads, board 1 ~12x

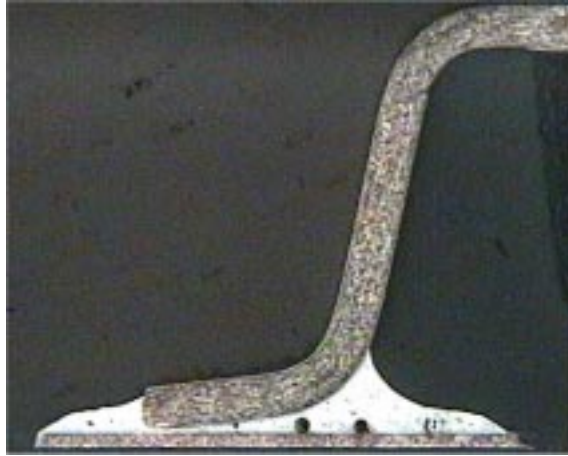


Figure 2 shows a solder joint formation of the left lead. Voids were shown at the board pad. 50x.

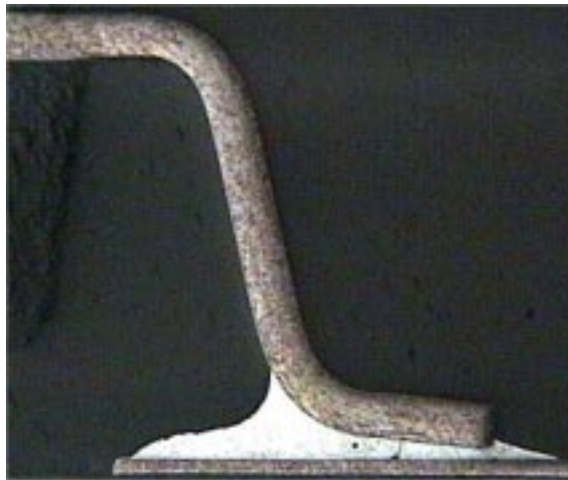


Figure 3 shows a solder joint formation of the right lead. 50x

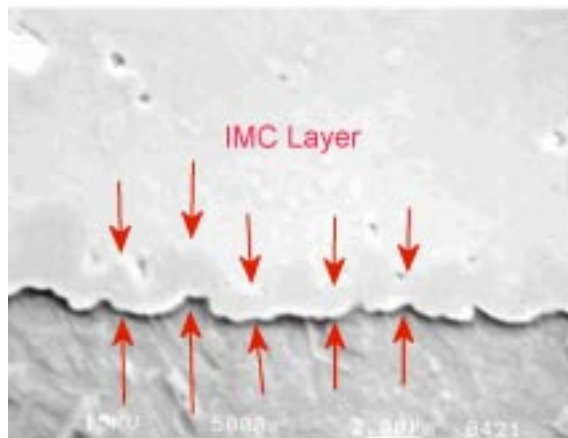


Figure 4, SEM image shows the IMC layer at the board side. The IMC layer thickness is about 2 to 3microns.

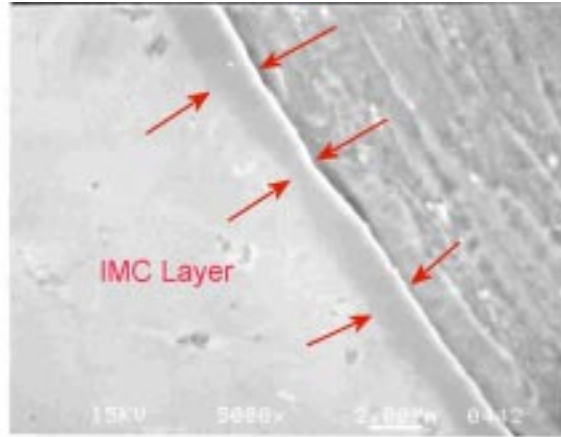


Figure 5, SEM image shows the IMC layer at the component side (heel). The IMC layer thickness is about 2 to 3 microns

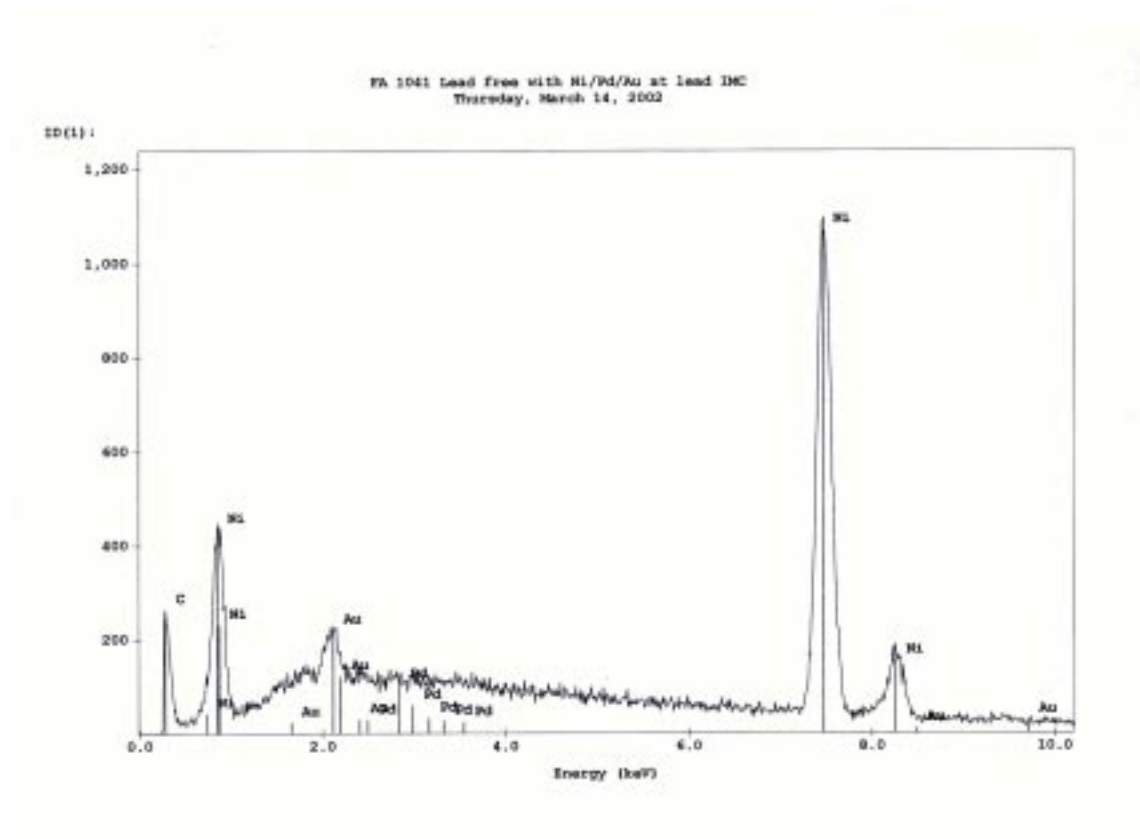


Figure 6, the EDX spectrum showed that there are the present of Ni, Pd, Au and no lead.

2.2 BOARD 2 - Lead free solder paste with Sn/Pb surface finished.



Figure 1 shows cross-sectional over view of U6 with left and right leads, board 2. ~12x

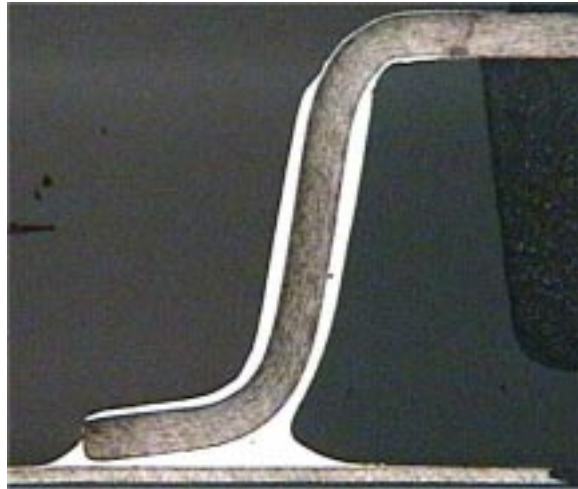


Figure 2 shows a solder joint formation of the left lead. 50x.



Figure 3 shows a solder joint formation of the right lead. 50x

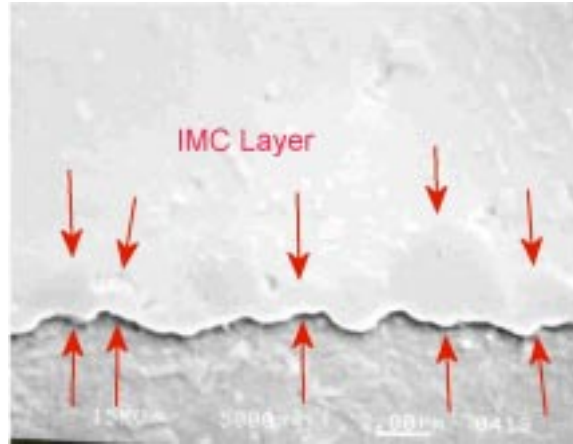


Figure 4, SEM image shows the IMC layer at the board side. The IMC layer thickness is about 2 to 3 microns.

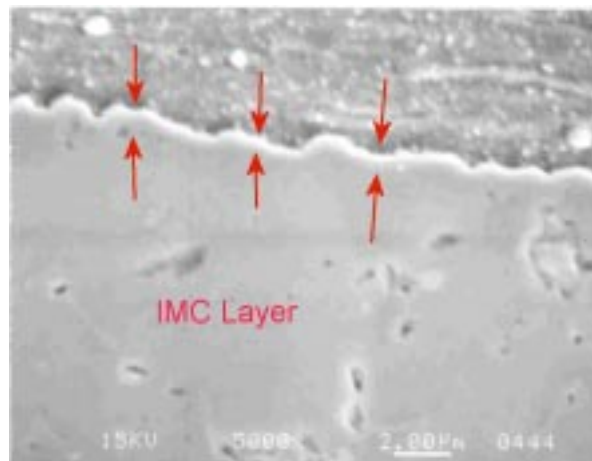


Figure 5, SEM image shows the IMC layer at the component side (heel). The IMC layer thickness is about 1 to 2 microns.

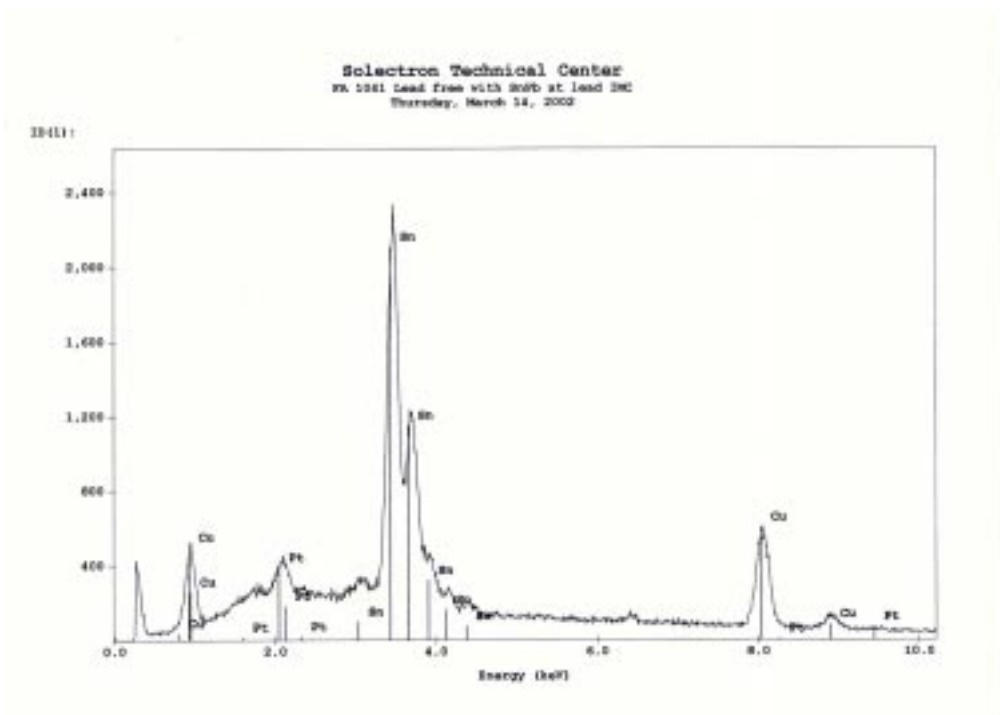


Figure 6, the EDX spectrum showed the presence of Sn and Cu.

2.3 BOARD 3 – Sn/Pb solder paste with Sn/Pb surface finished Leads



Figure 1 shows cross-sectional over view of U6 with left and right gull wing leads, board 3 ~12x

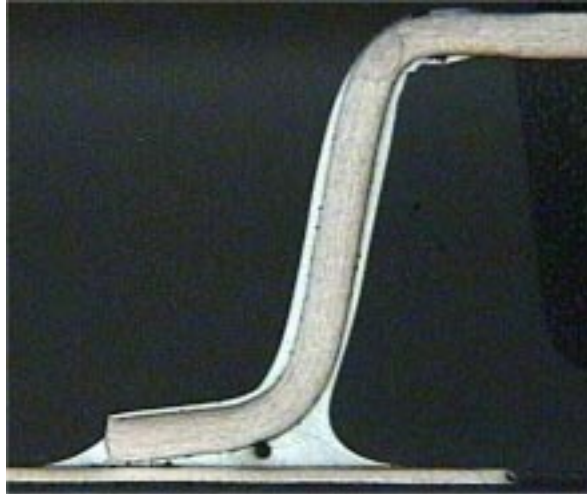


Figure 2 shows the solder joint formation of the left lead.

50x.

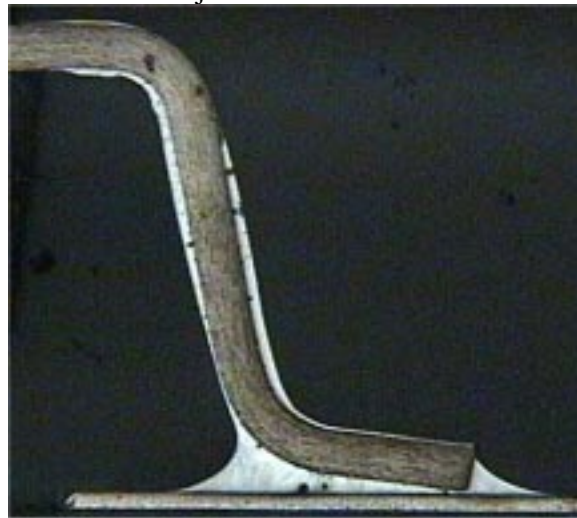


Figure 3 shows the solder joint formation of the right lead.

50x

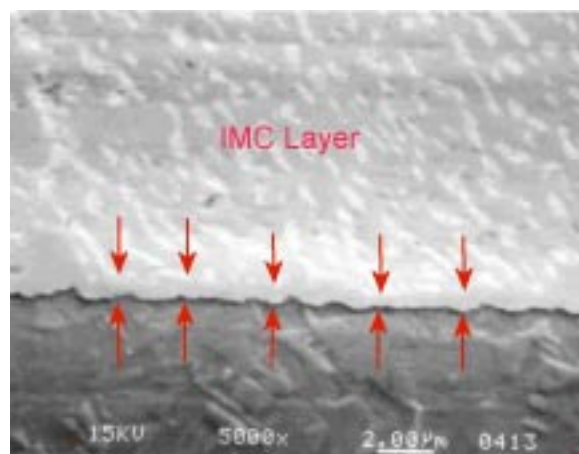


Figure 4 SEM image shows the IMC layer at the board side. The IMC layer thickness is about 1 to 1.5 microns.

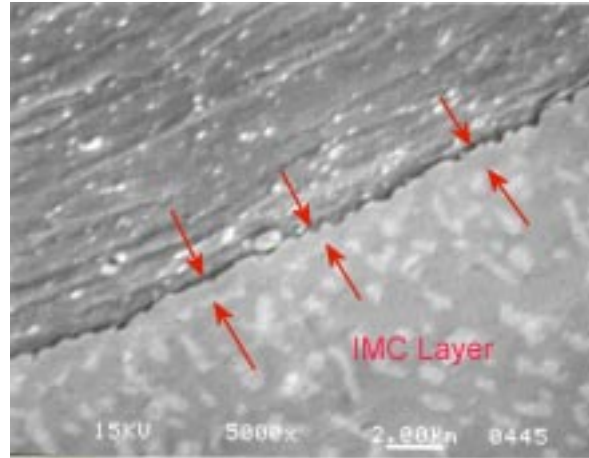


Figure 5 SEM image shows the IMC layer of the component lead (heel). The IMC layer thickness is about 1 to 1.5 microns.

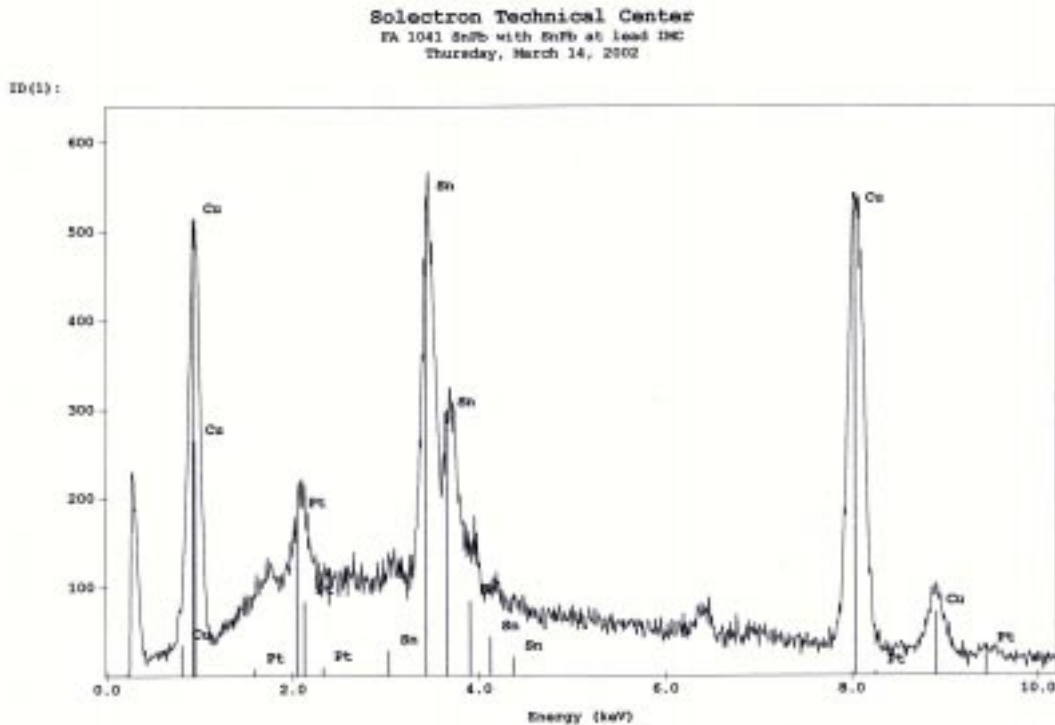


Figure 6, the EDX spectrum shows that the intermetallic is composed of Sn and Cu.

2.4 BOARD 4 – Sn/Pb solder paste with Ni/Pd/Au surface finished leads.



Figure 1 shows cross-sectional over view of U6 with left and right leads, board 4.

~12x

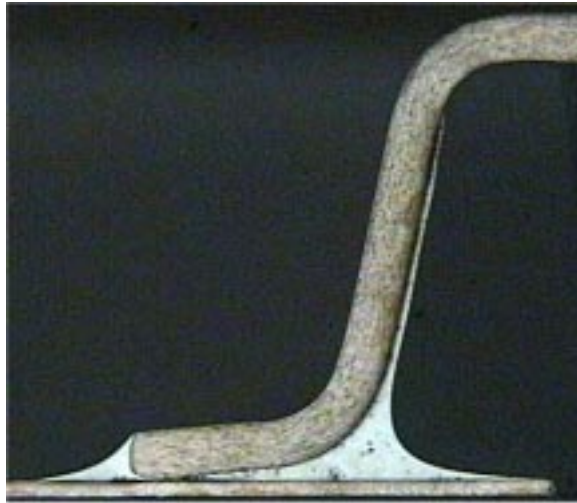


Figure 2 shows a solder joint formation of the left lead of board 4.

50x.

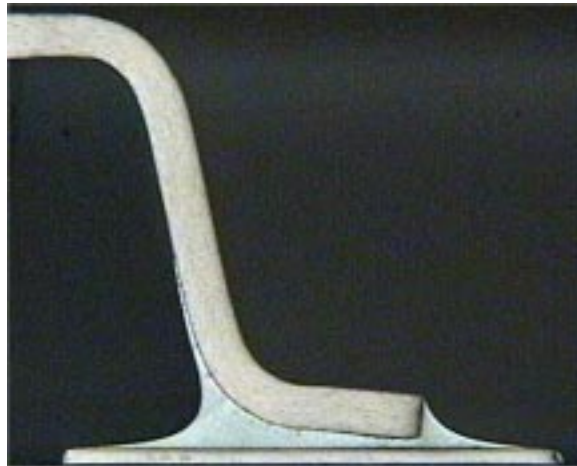


Figure 3 shows a solder joint formation of the right lead. 50x

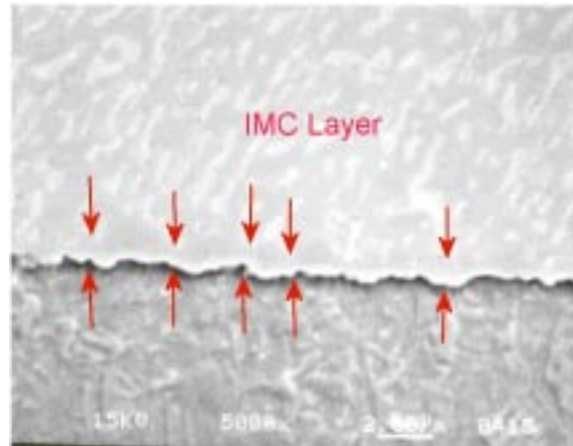


Figure 4 SEM image shows the IMC layer at the board pad.. The IMC layer thickness is about 1 to 1.5 microns.

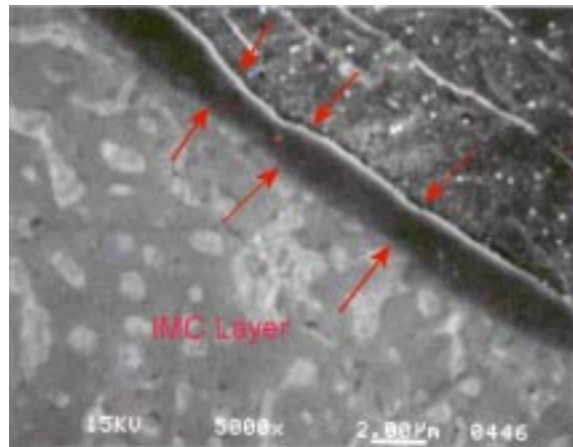


Figure 5 SEM image shows the IMC layer at the component lead side at the heel. The IMC layer thickness is about 1.5 to 2 microns.

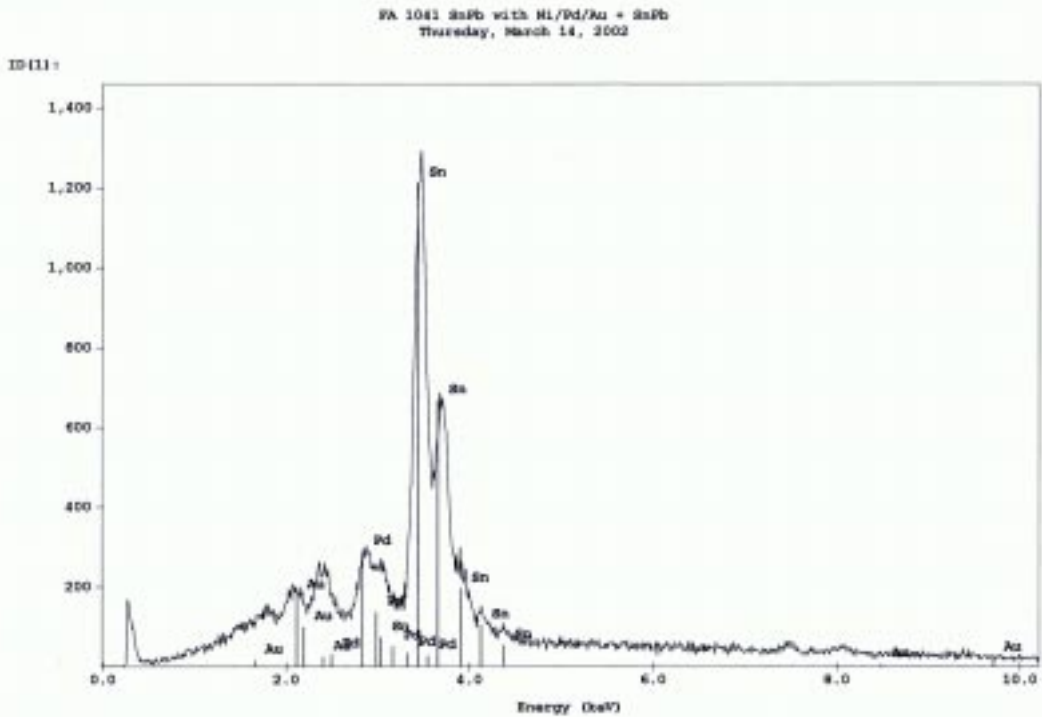


Figure 6, the EDX spectrum of IMC on component side at the heel of the lead shows the presence of Sn, Pd, and Au.