

# What caused the corrosion: The Question

Michelle Woolley - November 25, 2013

*Michelle Woolley has a puzzle for you. Figure out what caused the corrosion on the PCB. The answer posts December 2nd. Share your ideas in the comments.*

The case: corrosion on printed circuit board assemblies (PCBAs). Here is all the information we obtained through conversations and visits to the customer's facilities (because the corrosion was happening at the customer's sites). With this information, you can formulate your own theories. In "What Caused the Corrosion: The Answer," I will show you the resolution and explain it.

1. The PCBAs were from different facilities that were located in the southern part of China, Hong Kong, and Japan.
2. The corrosion was very extensive. In many cases, the PCB had been thermally degraded between two conductors. The conductors most affected carried voltage differentials of 180VAC. Figures 1- 3 show some of the most severe corrosion product that spread across the PCB surface.
3. Figures 4 and 5 show an optical image and a SEM image of a burned area clearly showing the damage to the PCB. In order to produce this damage, enough current must have passed between the two conductors to heat the wiring beyond its degradation temperature. The PCB had a degradation temperature greater than 260C. There were no anomalies associated with the printed wiring board (PWB).
4. The PCBAs are held vertically in a cabinet with forced air flow from the bottom front of the cabinet to the top of the back side where the fans are placed. This allows a diagonal air flow across the PCBAs.
5. Most of the corroded areas were not uniform around the centers but was biased toward one side as is shown in Figures 1 and 2.

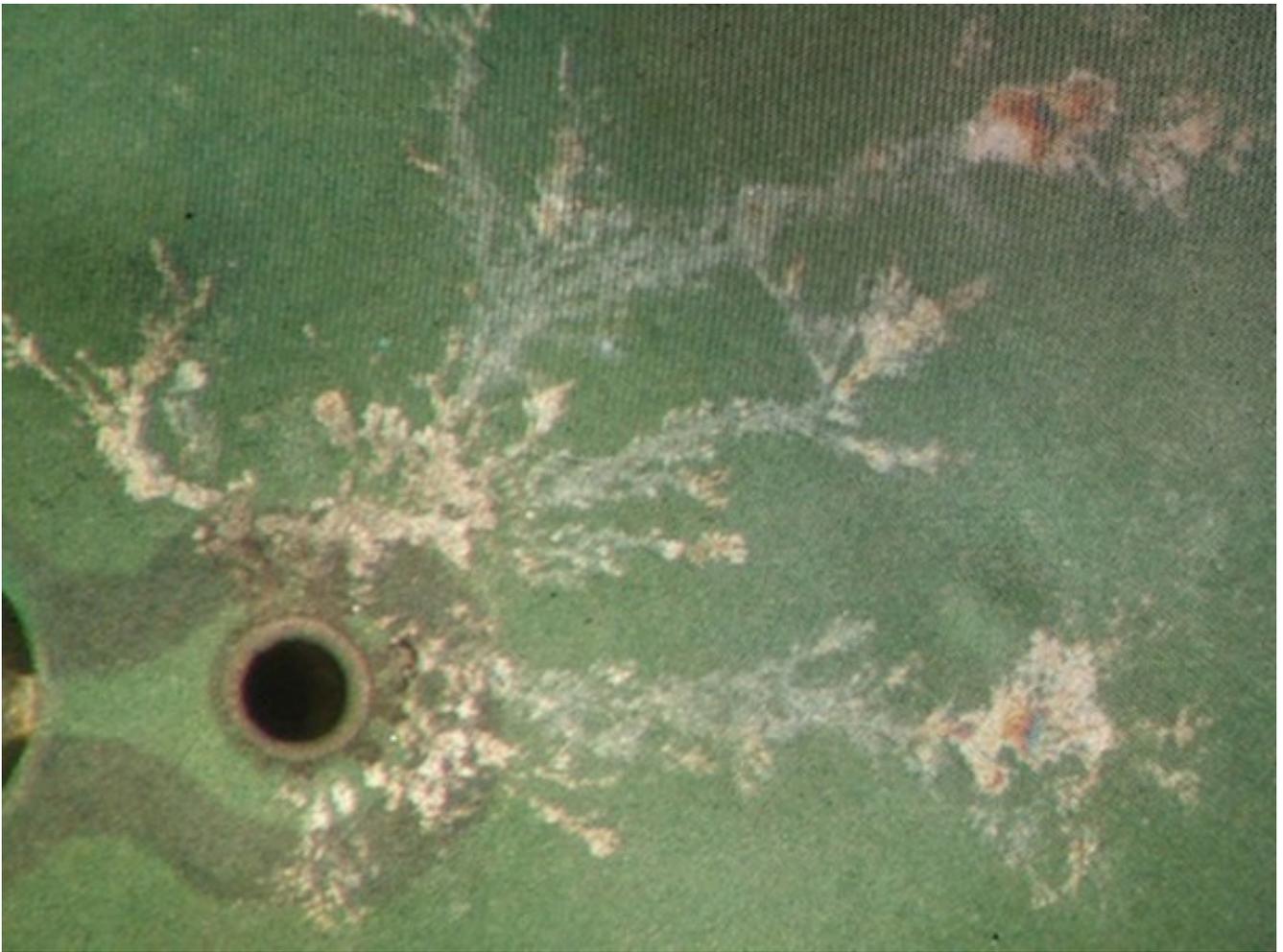


FIGURE 1



FIGURE 2

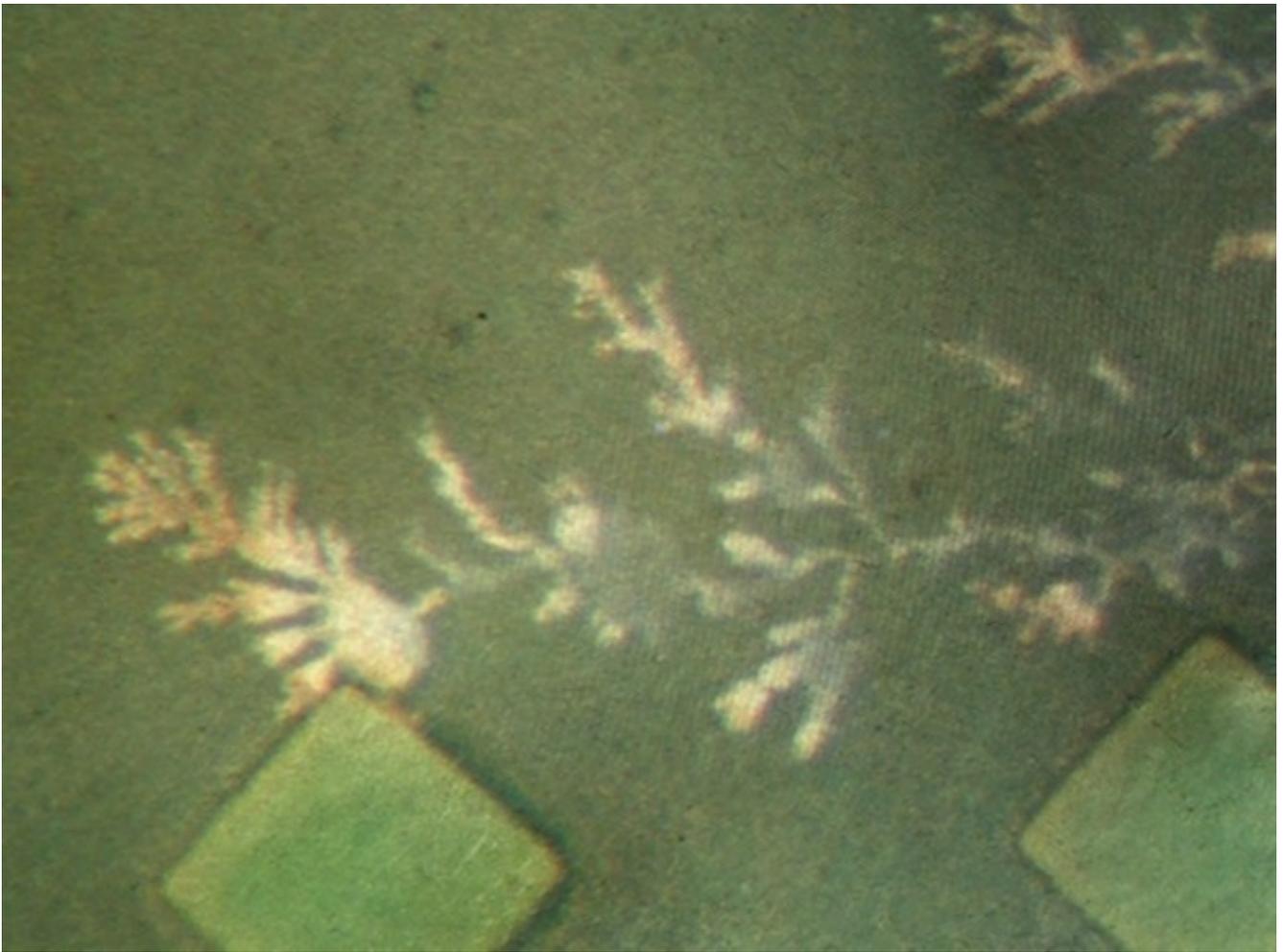


FIGURE 3



FIGURE 4

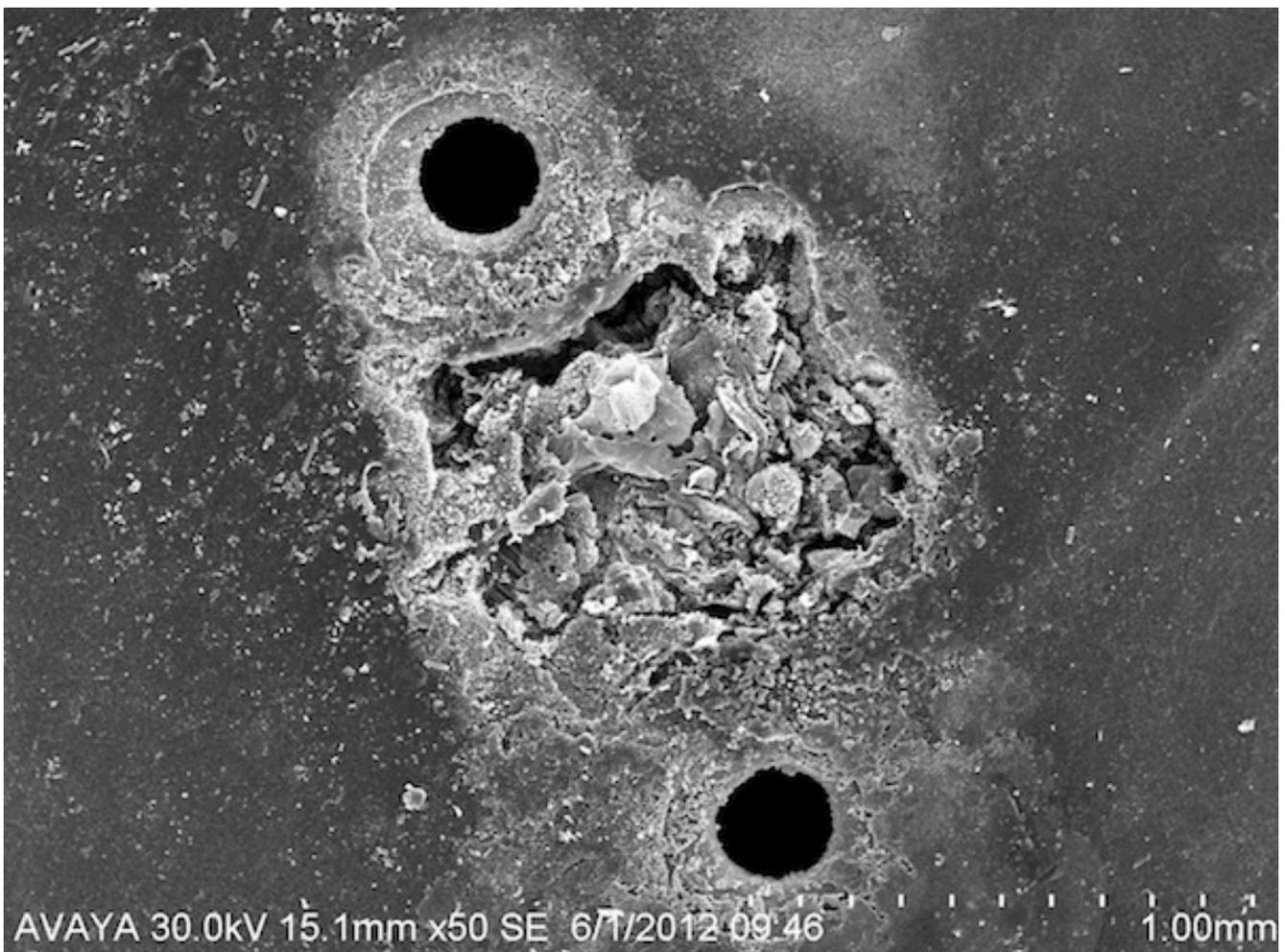


FIGURE 5

6. The PCBAs had been in use about two years before they began to fail.
7. PCBAs were manufactured and shipped simultaneously to the customer, but those kept in their original ESD bags were not affected. The ESD bags were not sealed, but were folded over before they were placed in the shipping carton. They were stored in the original shipping packaging.
8. Measurements were made of the temperature and humidity variations in the computer room where the equipment was operated. When the air conditioning was shut off each evening, there was an increase in both temperature and humidity. The air-conditioned temperature during the day was about 20C, and between 40% and 50% relative humidity. The temperature of the room at night reached 30C and the humidity increased to between 80% and 85%. These values were all within for the product's operating conditions.
9. Standard Corrosion test plates (copper and silver) were placed in the room and did not see significant corrosion during a 60-day period.
10. The main element detected in the corrosion product was sulfur. In some samples, chlorides were present. The presence of chlorides was not related to the amount of damage.

Now it is your turn. See if you can find the answer from the information supplied.

**Also See**

- Flux residues can cause corrosion on PCBs
- Successful PCB grounding with mixed-signal chips
- Wet Chemistry