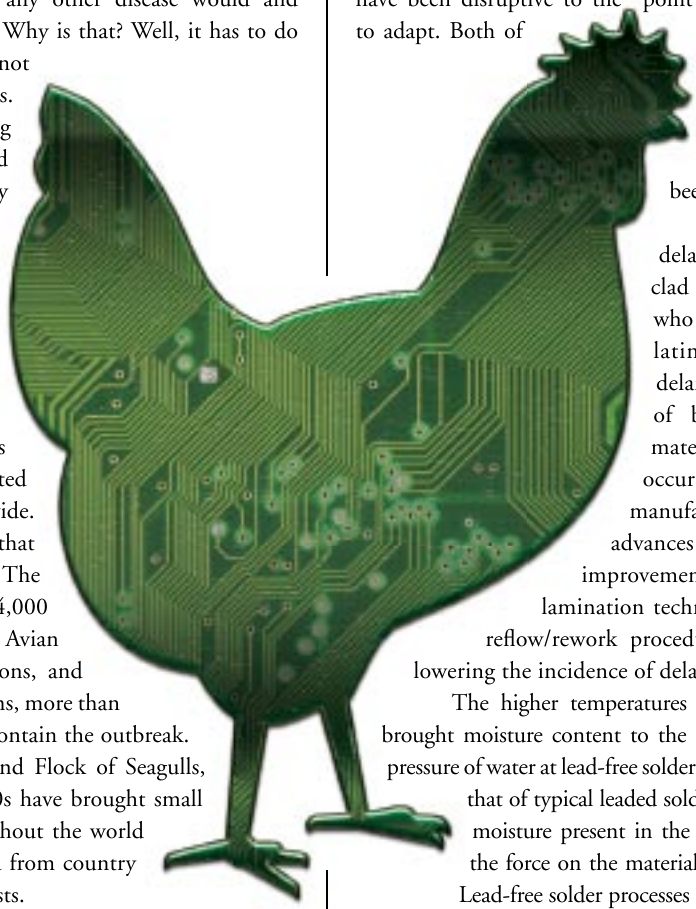
By Bob Neves

On the Subject of the Bird Flu and PCB Delamination

When I travel to our China facility, I am invariably asked if I am concerned about the bird flu. My response is that the bird flu worries me no more than any other disease would and less than some. Why is that? Well, it has to do with the fact that the bird flu has not spread beyond rare cases in humans. The scientific community is treating this situation with great care and preparing to rapidly respond to any potential outbreak. Is the bird flu new? Where did it "suddenly" come from? Contrary to what the news outlets might tell you about this "new" bird flu, its history dates back more than 80 years. Flu pandemics in general are not new and date back through recorded history. The 1910s saw the Spanish flu kill an estimated 20 to 100 million people worldwide. The 1950s brought an Asian flu that killed approximately one million. The 1960s saw the Hong Kong flu kill 34,000 Americans. The 1980s brought an Avian flu infection to U.S. bird populations, and although it didn't cross over to humans, more than 17 million birds were destroyed to contain the outbreak. Blurring the lines was the U.K. band Flock of Seagulls, but they too were spared. The 2000s have brought small outbreaks of human bird flu throughout the world and the ease at which it has traveled from country to country has alarmed many scientists.



Okay, now that I have your attention, you may ask how I plan to connect delamination to bird flu, since that is the impetus of my column title. To be honest, I felt that a catchy title would work, so I wanted to try something that didn't use "lead free" in the title (although that would have likely done the job). Secondly, outbreaks of delamination, like the bird flu, have periodically popped up since the advent of the printed circuit board.

Twenty years ago I had my first exposure to delamination as a significant industry-wide issue. I can't tell you how many delaminated boards I saw come through the lab. Looking back it is apparent to me that the emergence of delamination as a significant failure mode coincided with technology advances and the increased complexity of the electronics mounted on the PCBs. These advances and changes have pushed PCBs to higher layer counts, thicker overall structures, and thicker copper conductive layers that all have contributed to delamination's resurgence. The arrival of double-sided component mounting schemes and lead-free technology also sparked a resurgence in delamination failures.

Disruptive technologies have significantly increased the demands upon the PCB. Both surface mount and lead-free soldering technologies have been disruptive to the point of forcing the entire supply chain to adapt. Both of these technologies have increased the PCB's thermal exposure during soldering/rework, leading to delamination where there otherwise would have been none.

The early focus on fixing delamination fell upon the copper clad laminate (CCL) manufacturers, who worked diligently on inoculating their materials against delamination. The introduction of better, more thermally stable materials significantly lowered the occurrence of delamination. CCL manufacturers have continued material advances and this, in combination with improvements in copper surface treatment, lamination techniques, PCB design, and solder reflow/rework procedures, has gone a long way to lowering the incidence of delamination.

The higher temperatures of lead-free soldering have also brought moisture content to the surface (so to speak). The vapor pressure of water at lead-free solder temperatures is more than double that of typical leaded solder temperatures. This means that moisture present in the PCB will exert more than twice the force on the material at lead-free solder temperatures. Lead-free solder processes also typically require longer times of exposure above the T_g of the material promoting decomposition. The use of lead-free-compatible CCL and the careful control of moisture content in the PCBs is essential in reducing delamination, but at the same time there needs to be a significant focus on the optimization of the soldering/rework process.

If history has taught us anything, it is that outbreaks of defects will continue to occur as technology advances. This will continue to put pressure on the supply chain to adapt and improve or, if you will, inoculate against potential epidemic problems. Careful analysis, rapid response, and appropriate inoculation are the keys to overcoming these outbreaks. □

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