

Tin whisker inspection with Phenom™

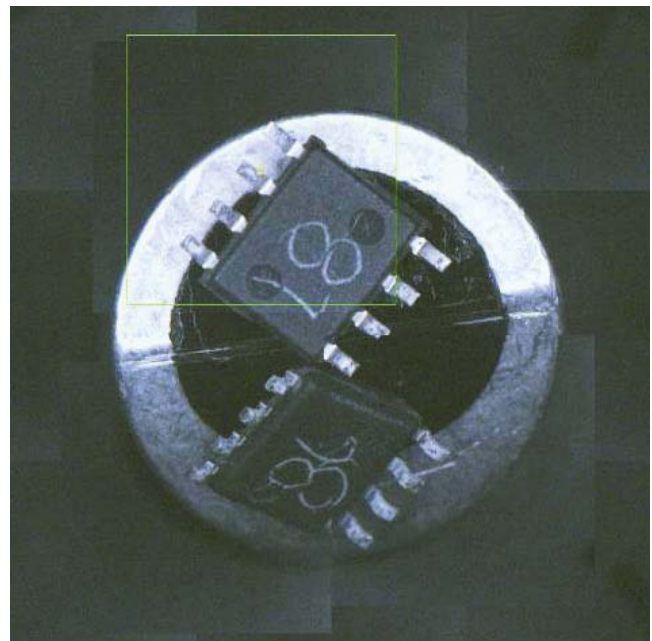
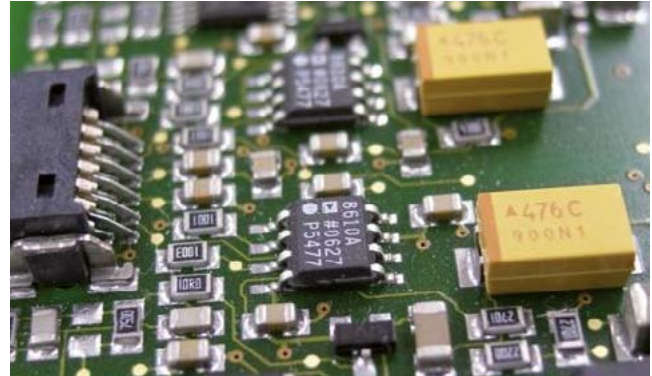
Recent legislation by many countries has banned the use of heavy metals such as lead, cadmium, and mercury. The biggest impact has been on the semiconductor industry. While the removal of these potentially harmful elements will eliminate potential health risks and environmental hazards, it also poses a new problem that could cost manufacturers billions.

The removal of the lead from the solder of semiconductor devices can cause and expedite the growth of tin whiskers. When lead is not mixed into the alloy, residual stress on the surface of semiconductor packaging leads can cause the growth of these crystalline structures. This creates a potential source of electrical shorting and arcing in chips.

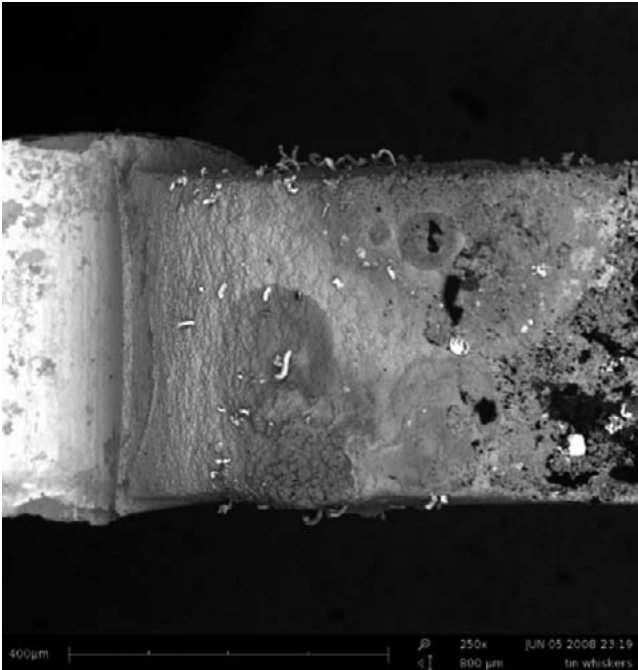
Tin whiskers have caused total system failures in computers, cell phones, missiles, and satellites. Analysts predict that these issues will become more frequent in this new solder-free semiconductor era. This note has been created to illustrate how to easily detect tin whiskers using the Phenom™.

The Phenom provides an excellent tool for the inspection of semiconductors for tin whiskers. It's simple to use navigation makes it easy to locate these tin whiskers and the online measurement tool makes it possible to measure these whiskers on the spot.

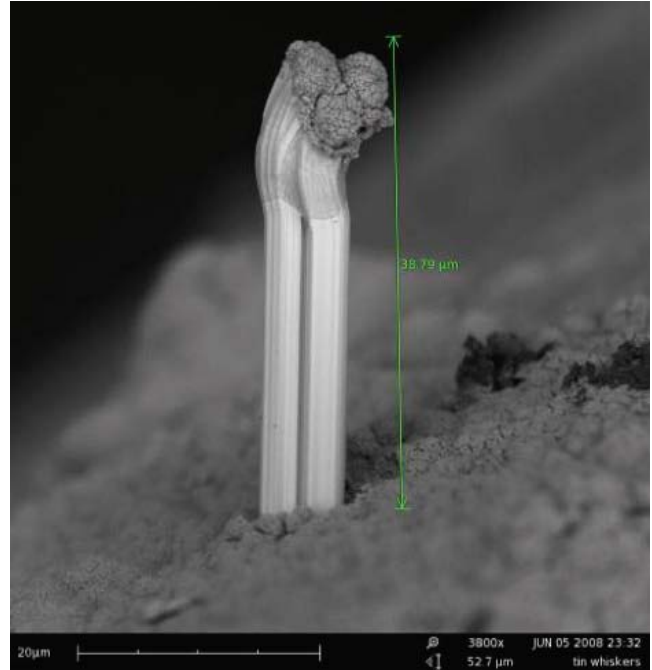
- First, place a semiconductor chip on a SEM pin mount. Samples can be mounted top down, in cross section, or on a 45 degree mount. Once the sample has been mounted and loaded into the machine, navigate to a packaging lead using the optical overview window (Figure 1).
- Browse around the packaging lead for any unusual looking structures protruding from the surface (Figure 2).
- Higher magnification Phenom images can give accurate tin whisker size data as seen in Figure 3.



Phenom optical image of two semiconductor packages. The optical overview allows the user to quickly and easily navigate around the package (Figure 1).



Low magnification (250x) SEM image shows unusual structures sticking out of from the packaging lead. These structures are indeed tin whiskers and potential sources of arching in the operational product (Figure 2).



Tin whisker at 3,800x magnification. The Phenom's online measurement function has been used to measure the height of this whisker at approximately 38.79 μm (Figure 3).



Tin whiskers at 3,750x magnification (Figure 4).

To learn more about tin whiskers visit NASA's webpage on this topic at <http://nepp.nasa.gov/WHISKER/background/index.html>.