

CALCE Prediction of Potential Failures Risks in Toyota Vehicles Confirmed by NASA Scientists

Investigations of Toyota vehicles have revealed tin whiskers in a critical component of their vehicle engine control system. At the September CALCE Conference on Tin Whiskers, Henning Leidecker and his team at NASA's Goddard Space Flight Center, who are recognized experts on electronic device failure and tin whiskers, presented their studies of tin whiskers on Toyota vehicles. They determined that the risk of failure due to tin whisker shorting in affected Toyota vehicles can be on the order of 50 to 150 per million. This figure agrees with the number reported in a recently published scientific journal article [Sood et al.] written by CALCE researchers Bhanu Sood, Michael Osterman, and Michael Pecht. They assessed the probability of a tin whisker-induced electrical short to be 140 per 1 million, based on whisker growth statistics.

Tin whiskers are known to grow from tin-finished surfaces and have been associated with costly failures of electronic systems. Linking tin whiskers to electronic product failure is often extremely difficult. Tin whiskers that bridge across terminations can create electrically resistive pathways. And since whiskers shift under an electrostatic field and can melt when the electrical current is drawn, they cause intermittent electrical behavior in systems.

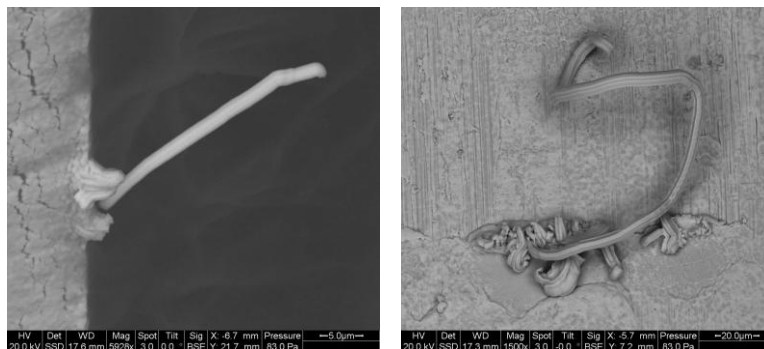


Figure 1 Tin whiskers on the edge of an acceleration position sensor board connection terminal in a 2002 Toyota Camry.

Considering the number of vehicles on the road, the presence of tin whiskers in engine control components presents a significant safety hazard. For this reason, best practices for electronics design stipulate that tin not be used as a plating material. It is very questionable why the National Highway Traffic Safety Administration—with its stated mission to “save lives, prevent injuries and reduce economic costs due to road traffic crashes, through education, research, safety standards, and enforcement activity”—has not come out with a requirement that no electronics use pure tin as a material component, since the potential for tin whiskers presents an unreasonable and unnecessary risk.

B. Sood, M. Osterman and M. Pecht, **Tin Whisker Analysis of Toyota's Electronic Throttle Controls**, *Circuit World*, Vol. 37, No. 3, 2011, pp. 4–9