Silver Epoxy Turns Black after an Oxygen Plasma Clean prior to Wire Bonding …but so what?

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ABSTRACT

In the early 1970s component manufacturers switched to epoxies for die attach in lieu of a eutectic attach. Resin bleed out was a common problem with these early epoxies and still is today. The exact cause of resin bleed is not clear, and the problem tends to vary from lot to lot and may have something to do with the surface porosity of the substrate. Resin bleed is difficult to see unless a filtered light source is connected to the microscope. The easiest and most effective manner to clean epoxy resin bleed, and other outgassed organic species, is to expose the assembly to a UV Ozone or an O_2 plasma treatment just prior to wire bonding. However, oxygen plasma turns the silver die attach epoxy black. Customers often take offense to this color change and hence O_2 plasma cleaning prior to wirebond in large microwave hybrids is normally not performed. Argon plasma is often used as a follow up to reduce the black oxidized epoxy. instead. This presentation reviews the chemistry involved in the formation of "black epoxy" and how the silvery epoxy appearance can easily be restored, thereby allowing for a more aggressive clean prior to wirbeond. Rework of wire no sticks or multiple wirebond attempts on the same pad is a major concern in the manufacture of large area microwave hybrids and a big contributor to expensive rework cycles.

Key Words: Plasma clean, Resin bleed, black silver epoxy, Visual Inspection, MIL-STD-883 TM 2017

Thomas J. Green has more than 38 years combined experience in industry/academia and the Department of Defense, including years developing curriculum and teaching industry professionals about microelectronics assembly-related packaging and processes. Serving as a Research Scientist at the U.S. Air Force Rome Air Development Center, Tom worked as a reliability engineer analyzing component failures from fielded avionic equipment. As a Senior Process Engineer with Lockheed Martin Astronautics in Denver, Tom was responsible for materials and processes used to assemble hybrid microelectronic components for military and aerospace applications. While with Lockheed, he gained invaluable experience in wirebond, die attach, thick- and thin-film substrate fabrication, hermetic sealing, and leak test processes. For the last 15 years, Tom's expertise has helped position his company as a recognized industry leader in teaching and consulting services for high-reliability military, space, and medical device applications. Tom is a Fellow of IMAPS (International Microelectronics and Packaging Society)