

Electronics Packaging

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http://ece.pdx.edu/Labs/nano_packaging_lab.html



Electrically conductive adhesives (ECA) are compositions of conductive filler dispersed in a polymeric matrix and are widely used as Pb-free alternatives to conventional solders. Anisotropic conductive adhesives (ACA), for example, only conduct in the z-direction, and are used for the electrical connections between the circuit board and LCD display on laptop PCs.

The current investigations deal with isotropic conductive adhesives (ICA), which ideally conduct equally in all directions. Zero force assembly provides an advantage over ACAs, and both have a low temperature processing advantage over no-Pb solders for process technology and tolerances.

Due to new environmental regulations, conventional solders are being replaced with no-Pb alternatives in PWB assembly. Recently developed no-Pb solders exhibit good performance, but need higher temperature processing. Electrically conductive adhesives offer another option, due to lower process temperatures. ECAs are widely used in industry, but basic mechanisms and properties are still not fully understood, and reliability questions persist.

High Frequency Modeling One of the major advantages of ICAs is in high frequency applications, where the lower resistivity of the filler material yields better performance than solders when skin effect is included. Data and modeling have both been concentrated on anisotropic conductive film (ACF) to date.

Our current studies use ICAs, where shrinkage during cure is the driving force to establish current flow, rather than external pressure.

A computer model is being developed to simulate the influence of the percolation system on high frequency behavior, and will be compared with experimental data.

Reliability Testing Despite their many advantages, reliability is an issue when dealing with epoxy-based materials. Due to water absorption, electrochemical corrosion is a more common failure mechanism than electromigration.

Investigations will deal with various electrical conductive adhesives paired with different contact materials. The project will continue earlier work on the reliability effects of pre-heating and vacuum processing on reliability. Environmental and mechanical cycling are supplemented by drop testing, high current stress, etc.



Nanoelectronics packaging is another new project being started in this field. The group is also developing the ICA literature database (ontology) for the IEEE.

Equipment:

- 2 automated ASYMTEK dispensing stations
- WELTEK 68 MC Screen Printer
- PROTOMAT PWB Prototyping machine
- NOVASTAR Reflow oven
- DESPATCH Environmental chamber
- AGILENT HP4194A Impedance Analyzer
- KEITHLEY 6430 Nanovoltmeter

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