Micro-Coaxial Cable Stripping with Electronic Flame-Off Process

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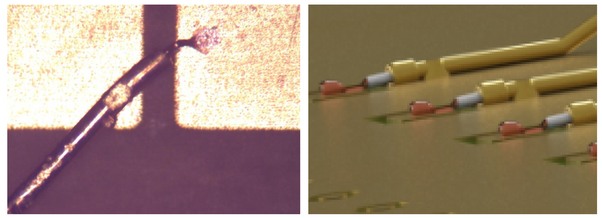
Overview

- Micro-coaxial cables (MCCs) have been developed as shielded interconnects in micro-electronic devices
- Low tensile strength of MCCs limit viability of traditional wire stripping techniques
- Electronic Flame-Off (*EFO*) is currently used in commercial wire bonding tools
- EFO was employed as a means of stripping back shield and dielectric from MCCs with 25 µm core diameters
- Results indicate decomposition temperature of the polymer insulation and thickness of the shield are key determining factors in successful stripping

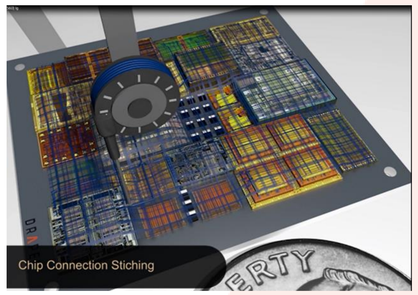
Stripped MCCs bonded with independently bonded core and shield contacts



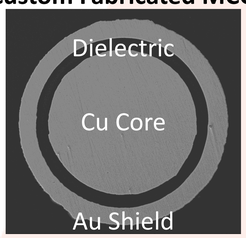
Why Micro-Coax?

- Saves circuit design and simulation time because each trace is individually shielded
- Reduces fab time by eliminating iterative lithographic processes, employing wire-only interconnect process
- Allows for greater interconnect density by minimizing crosstalk and external interference

Enables high density interconnects for multi-chip modules



SEM Cross Section of Draper Custom Fabricated MCC



End-Wire EFO

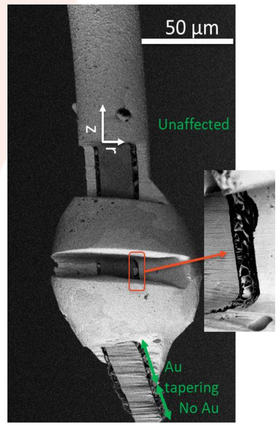
- End-wire stripping was performed by grounding the MMC's shield and applying a high-voltage to an EFO wand using a power supply from a commercial wire bonder

High-Speed Video Frames

BSD SEM Image of EFO Stripped MCC

Dielectric decomposition temperature is critical in preventing shorting

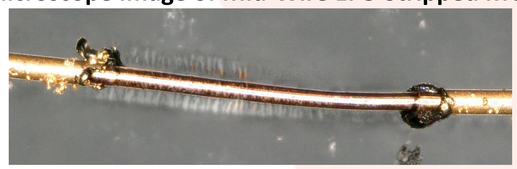
FIB Cross-section of MCC



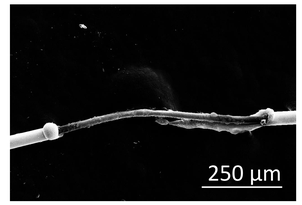
Mid-Wire EFO

- Mid-wire stripping is crucial for continuous wire feeding and bonding
- Controlling gold thickness is a critical factor in EFO success, as too much gold can impede proper stripping

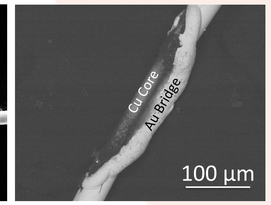
Microscope Image of Mid-Wire EFO Stripped MCC



EFO Success



EFO Failure

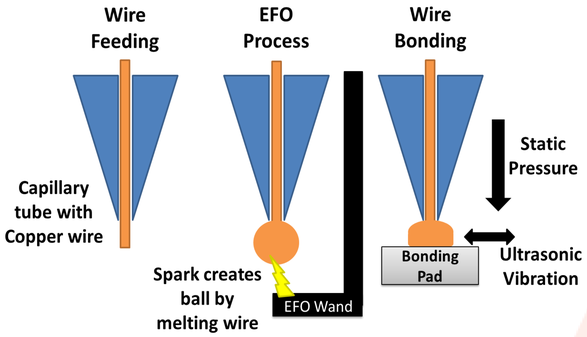


- Gold shield fails to circumferentially strip, leaving gold "bridge"

Failure of EFO strip is due to too much gold

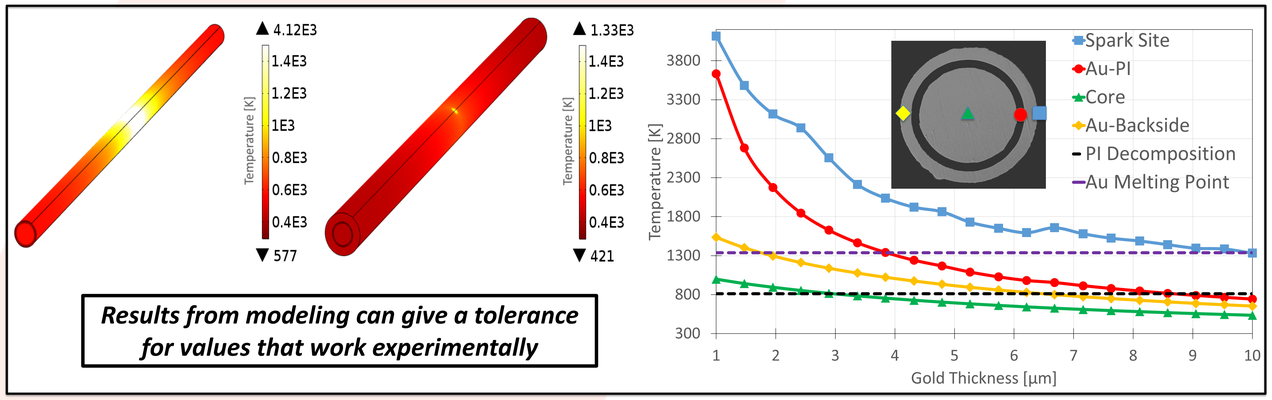
EFO and Current Applications

- *EFO* employs a plasma discharge to rapidly heat a bonding wire to form a *Free-Air Ball* (*FAB*)



Modeling

- ***Questions to answer:***
  1) Can we predict if dielectric will remain at core-shield interface?
  2) What is the optimal shield thickness for circumferential stripping of a given length?



Results from modeling can give a tolerance for values that work experimentally

Process Challenges

Wire Conductivity	Dielectric Thickness	Shield Thickness
Damage to Dielectric	Mechanical Strength	Production Volume

Conclusions / Future Work

- EFO can be used to selectively strip shield and dielectric materials from MCCs
- High decomposition temperature of the polymer dielectric is crucial for maintaining core-shield isolation
- Shield removal is dependent on Au shield thickness
- For MCCs with 25 µm cores, 1.3 µm PI and 5 µm Au shield thicknesses are ideal

Future Work: *Statistical analysis needs to be performed on core-shield shorting of EFO stripped wires*