Ultra Low Leakage Probes & Cables 
For Fine Pitch Probe Cards 

Hiroyuki Kamibayashi 
Mitsubishi Cable Industries
Agenda

- Introduction
- Need for superior quality coated probes
- Advantages of MEXCEL electro-deposited polyimide coatings
- Need for super-fine coaxial cable products
- Advantages of Mitsubishi ultra miniature coaxial cables
- Summary
Mitsubishi Product Divisions

• **Cable Division**
  – Electric wires and cables, high frequency cables

• **Instrument Components Division**
  – Seals, rubber products, engineering plastic products, metal products, OA equipment, electromagnetic wave absorbers, MEXCEL products.

• **Car Electronics and Optics Division**
  – Automotive wire harnesses, connectors, gaskets, data link and optic devices, optic fiber bundles, optical large core fibers
(France) Dia Automotive Systems, S.A.S

(China) Dalian Ryosei Automotive Components Co., LTD.

(China) Dalian Liaison Office

(Korea) Dia Automotive Systems Korea Co., LTD.

(China) Shanghai Liaison Office

(Thailand) Thai Summit MCI Component Co., LTD.

(Thailand) MCI & TSH Co., LTD.

(Indonesia) P. T. Dia Electro Circuit Systems Indonesia

(Indonesia) P. T. MCI Prima Gasket

(U.S.A.) Mitsubishi Cable America Inc. Santa Clara CA 408-486-9915
PART 1

• This section features the MEXCEL coating process developed by Mitsubishi’s Instrument Components Division

• This process can be used to advance performance of fine-pitch coated probes.
Need for Superior Quality Coated Probes

• High resistance for low leakage applications

• High breakdown for high voltage applications

• Coating must be tough, peel resistant, and withstand high temperatures

• Coating must be thin for tight pitch applications and free of pin hole defects

• Barrier to corrosion, chemicals & Moisture
The MEXCEL Coated Probe

• Polyimide is applied by a patented electro-deposition process

• Much superior to dip-coatings or the use of polyimide “sleeving”

• Tight control over thickness and uniformity
  – Coatings from 1 micron to 100 microns thick
  – Uniformity better than 5%
  – Free of bubbling and pin holes
MEXCEL Manufacturing Method

Material: Polyimide
Thickness: 1 to 100μm
Coating Length: As you like

Example of coated probe pin

Thickness is Tightly Controlled
The uniformity of the coating and ability to withstand extreme flexing and bending is ideally suited for the abuse probe needles experience.
A 10 micron coating reliably exceeds 1KV AC breakdown. For fast pulse ESD applications the expected breakdown is 4x higher.
Other Applications

- Thermistor
- Lead Frame
- Planar Transformer
- High Inductance Planar Coil
- Pipe
- Spring
PART 2

• The section features ultra miniature coaxial cable developed by Mitsubishi’s Cable Division.

• Original developed to advance miniaturization of mobile products, these cable are well suited for use in many probe card applications.
Need for Super-Fine Coaxial Cable Products

• **Ultra low leakage DC applications**
  – Driven guard eliminates probe capacitance allowing much faster settling time fA-level measurements

• **Controlled impedance RF applications**
  – Miniature 50-ohm flexible probes are possible using tungsten wire as the inner conductor.
  – These can help solve routing problems in tight pitch applications where flexibility is an issue
Construction of Ultra Miniature Coaxial Cable

Only 210 micron outside diameter! (8.3 mils)

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<th>Construction</th>
<th>O.D (µm)</th>
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Impedance of Ultra Miniature Coaxial Cable

Characteristic impedance (TDR) of 50±3 ohms can be achieved with 210 μm in overall diameter.
Ultra Miniature Coaxial Cable Handles 8KV ESD Pulse

This cable/probe allows flexible routing of ESD pulse waveforms in fine pitch applications.

Measurement courtesy of www.grundtech.com
Construction of Mini Low-Loss Cable

Flexible low-loss cable is 810 µm O.D. (31.9 mils)

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</table>
Attenuation of Mini Low-Loss Cable

- Mitsubishi cable: 2000MHz, 2.6dB/m
- General cable: 4.3dB/m

Frequency [MHz]
Attenuation [dB/m]
VSWR of Mini Low-Loss Cable

- Length: 2m
- Connector: SMA Plug

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<th>Frequency [MHz]</th>
<th>VSWR</th>
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810 Micron OD
Other Mini Low-Loss Cable Applications

Mobile PC

Coax Cable

Mobile Phone

June 6 to 9, 2010

IEEE SW Test Workshop
Summary

• **Electro-deposition produces superior coated probes**
  – MEXCEL coatings can advance tight pitch probing application
  – They extend probing at high temperatures and voltages

• **New miniature coax cable advances signal technology**
  – Cross sections in 200 micron are now possible
  – Wide bandwidth, temperature, and voltages are achievable
Next Step

• **These advance technologies require partnerships**
  – Mitsubishi Cable Industries wishes to partner with probe card vendors and/or end users to provide custom solutions for the semiconductor wafer test industry.

• **Custom probe coatings and cables**
  – In the US, please contact Mitsubishi Cable America
    3333 Bowers Avenue, Suite 251
    Santa Clara, CA 95054
    408-486-9915
    Yutaka Ikeda
    ikeda@mcausa.com