

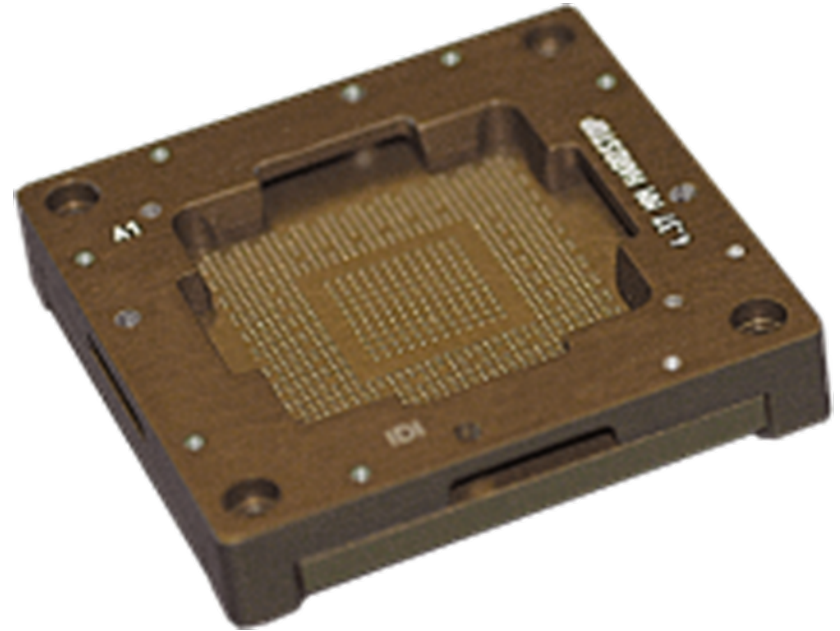
# Sterner Stuff: an Improved Material for High Performance Test Sockets

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# Overview

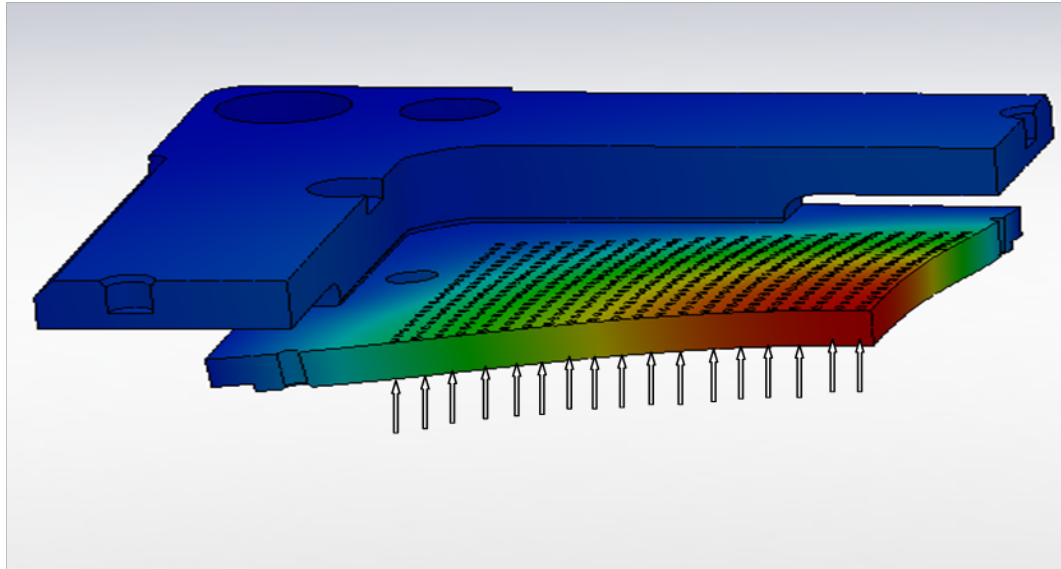
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- ◆ Discovery process
- ◆ Challenge statement
- ◆ Embodiment
- ◆ Summary



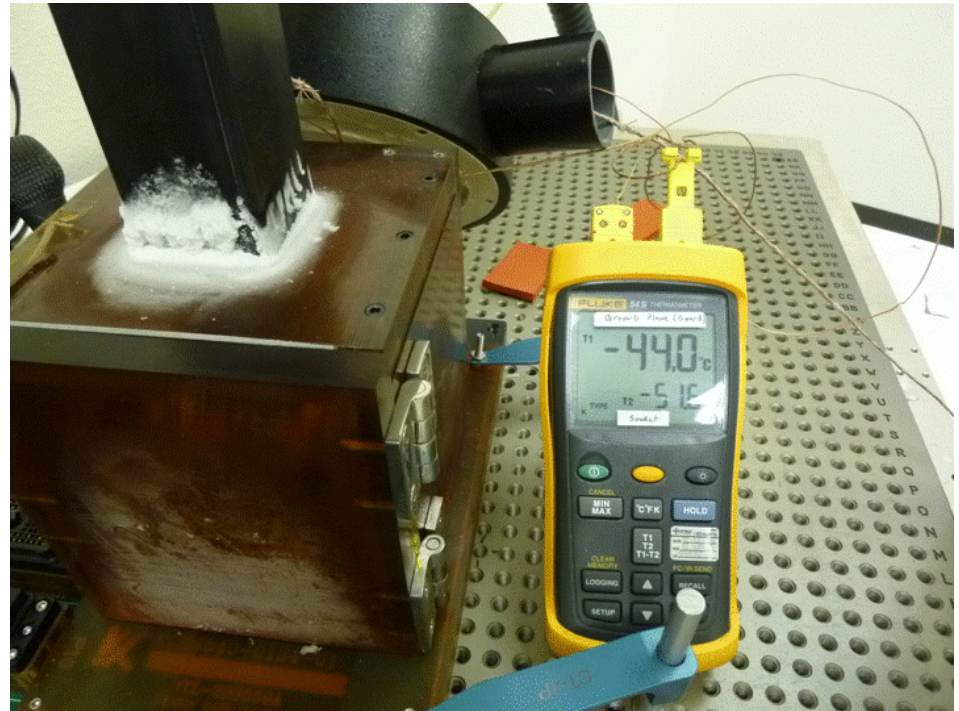
# Discovery Process

- ◆ Plastics present difficulty in socket fabrication and application
- ◆ Metal has significant mechanical advantages
- ◆ Durable insulated metal would be a significant advancement



# Discovery Process

- ◆ A durable means of insulating metal was discovered
- ◆ Durability was quantified through 500K insertions using leakage current testing at ambient, 150C, -55C



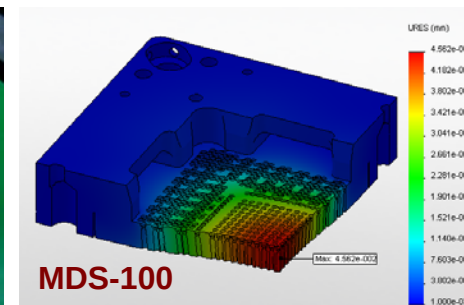
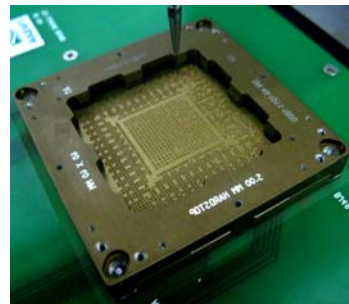
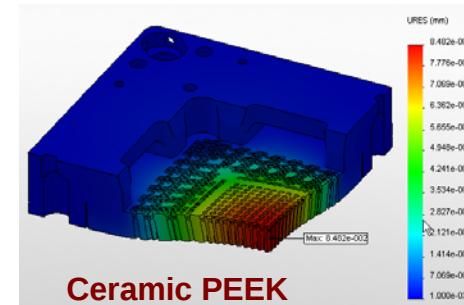
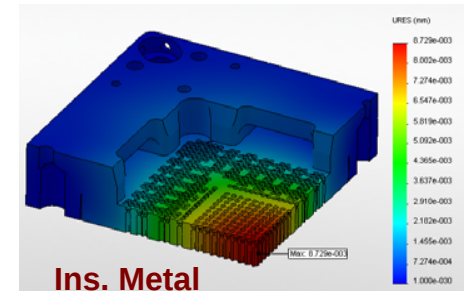
# Material Properties

## Max Deflection due to Preload

| Material              | Ins.<br>Metal | Ceramic<br>PEEK | MDS-100 |
|-----------------------|---------------|-----------------|---------|
| Max Deflection,<br>mm | 0.009         | 0.085           | 0.046   |

| Material           | FEA   | Measurement |
|--------------------|-------|-------------|
| Max Deflection, mm | 0.009 | 0.008*      |

\* Within measurement error range.

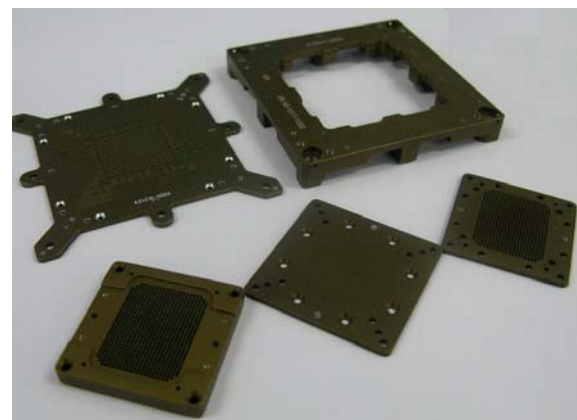


# Material Properties

## Surface Resistivity

- Comparable to anti-static / ESD plastics
- Passes leakage through 1000 V

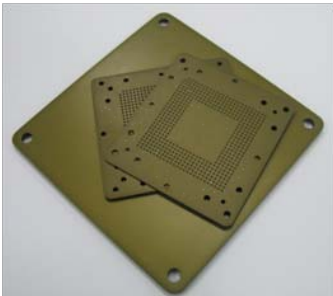
| Material                           | EKH<br>SS09 | Ins.<br>Metal               | Cer.<br>PEEK | TORLON<br>4203 |
|------------------------------------|-------------|-----------------------------|--------------|----------------|
| Surface<br>Resistivity<br>(Ohm-cm) | $\sim 10^9$ | $10^{10}$<br>~<br>$10^{11}$ | $> 10^{13}$  | $> 10^{16}$    |



# Material Properties

## Mechanical Strength and Hardness

- Much stronger than all common socket plastics
- Hardness ~400HV; composite materials do not exceed 200HV

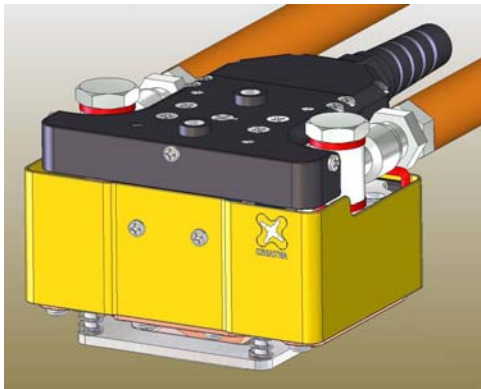


| Properties (MPa)          | Ins.<br>Metal | Ceramic<br>PEEK | Semitron<br>MDS 100 | Torlon<br>4203 |
|---------------------------|---------------|-----------------|---------------------|----------------|
| Elastic Modulus           | 70300         | 4482            | 10340               | 5000           |
| Tensile Yield<br>Strength | 193           | 89              | 101                 | 123            |

# Material Properties

## Temperature and Humidity

- Does not absorb water; stable dimensionally in all humidity
- High thermal conductivity and temperature range



| Properties                                              | Ins.<br>Metal | Cer.<br>PEEK | MDS<br>100 | Torlon<br>4203 |
|---------------------------------------------------------|---------------|--------------|------------|----------------|
| Water Absorption, %                                     | 0.00          | 0.00         | 0.1        | 0.33           |
| Max Working Temperature, °C                             | 260           | 260          | 249        | 260            |
| Melting Point, °C                                       | 593           |              | 335        | -              |
| Thermal Conductivity, kcal / hour / M <sup>2</sup> -° C | 119           | 0.3          | 0.2        | 0.2            |

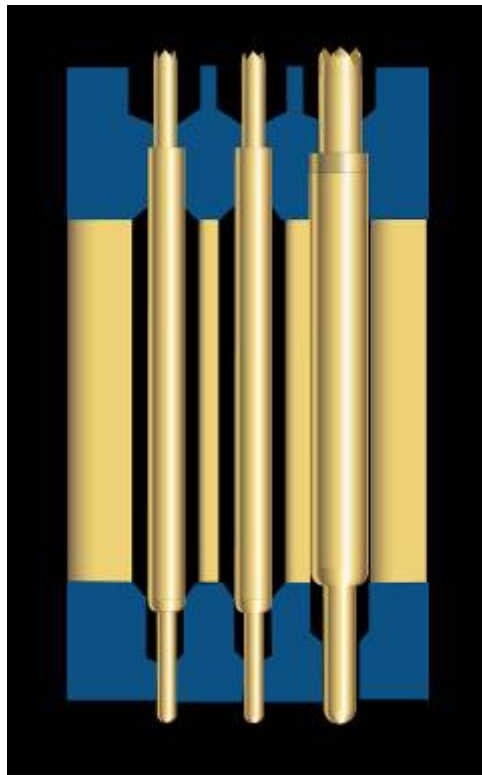
# Embodiment



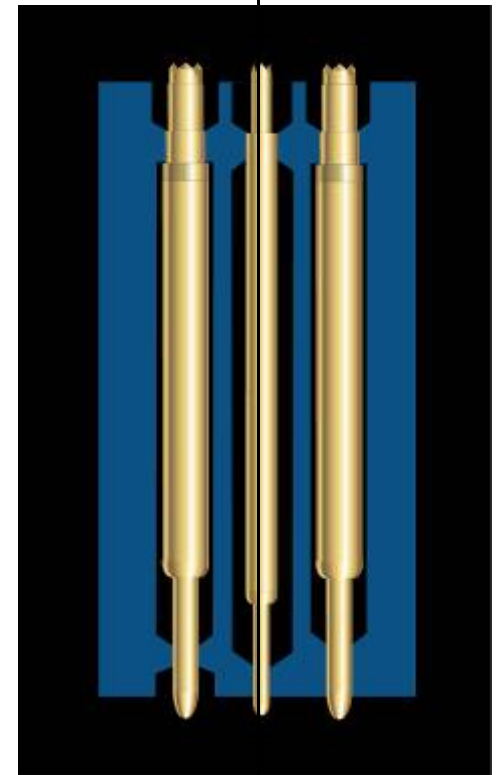
3 mm Probe



Conventional Coax



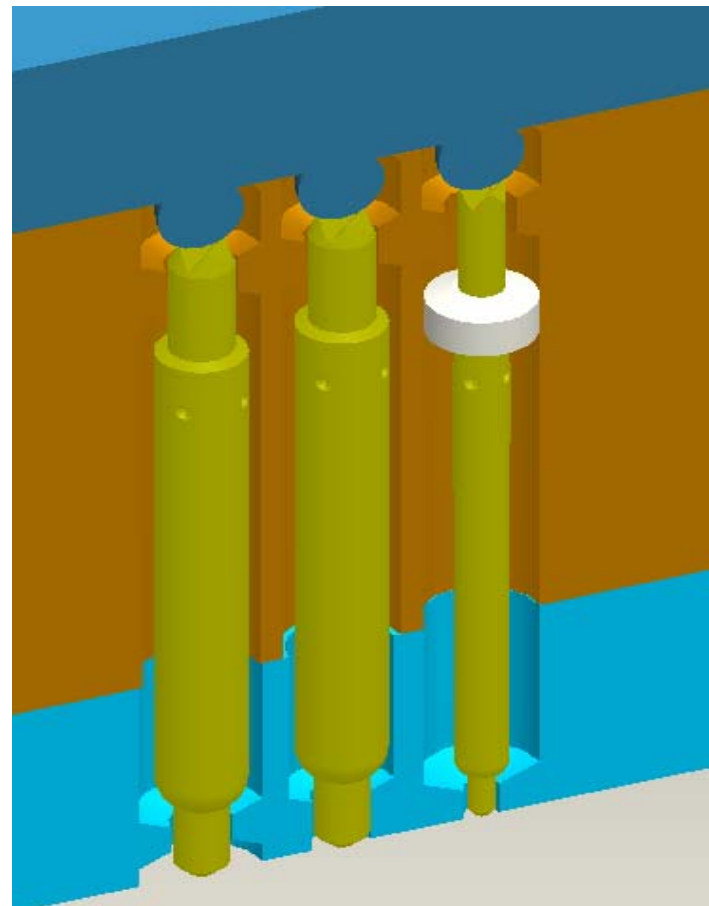
'DaVinci'



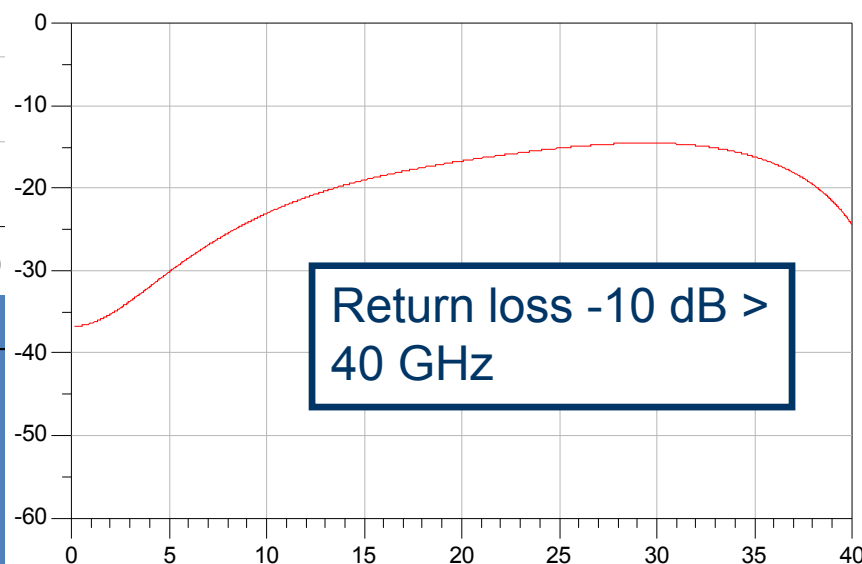
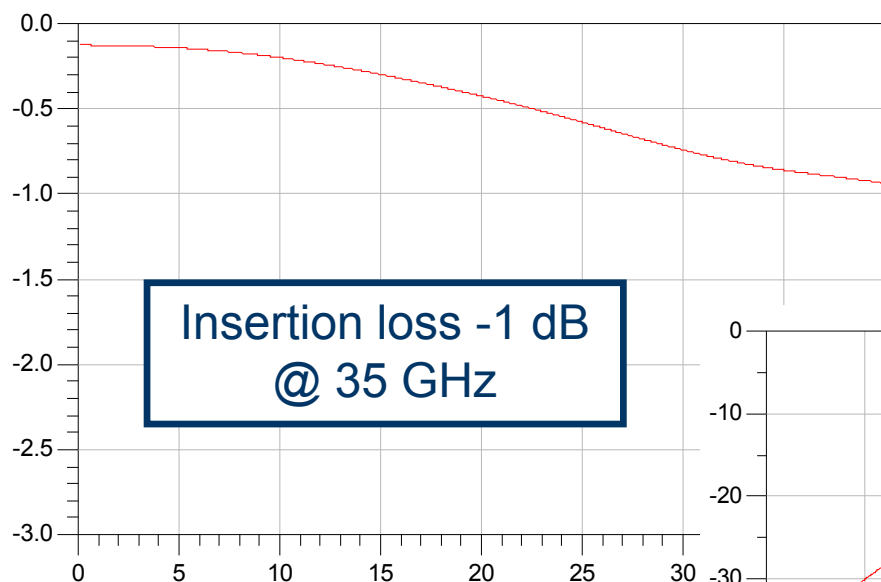
# Embodiment

Coaxial structure using insulated metal has two primary benefits:

- ◆ Impedance is controlled from tip to tip
- ◆ Power delivery is at low inductance



# Embodiment



# Summary

- ◆ Insulated metal offers significant advantages over all known plastics
- ◆ Coaxial embodiments offer transparent signal integrity

