Silver plating tungsten (W) and tungsten-rhenium (WRe) probes provides advantages over traditional nickel plating by reducing the DC-resistance and increasing the current carrying capacity.

Traditionally, W and WRe-probe needles used in cantilevered probing applications are electroplated with nickel to facilitate solderability to probe card PCBs. The nickel layer provides little improvement in the overall probe needle electrical performance. Plating W and WRe-probes with a 200- $\mu$ in thick layer of silver maintains the solderability and replaces the nickel layer with a significantly more conductive material. Table 1 compares the resistivity values of probe needle and plating materials.

Tungsten	Tungsten-Rhenium	Plated Nickel	Plated Silver
5.5 to 5.9 μΩ-cm	9.2 to 10.1 $\mu\Omega\text{-cm}$	7 to 40 $\mu\Omega\text{-cm}$	1.6 to 3.2 μΩ-cm

Table 1 - DC resistivity of probe needles and plating.

In Table 2, the effects of silver plating on probe resistance (determined from Ohm's Law) and ampacity (based on power dissipated by heat) for several W and WRe-probe needle diameters are summarized.

Probe (2.0 in)	Nickel Plated Probe Resistance (mΩ)	Silver Plated Probe Resistance (mΩ)	% Resistance Reduction	% Ampacity Increase
W005	229	149	35.2	19.5
W008	87	66	24.6	13.2
WRe005	376	200	47.1	27.3
WRe008	140	92	34.4	19.0

Table 2 - Effects of silver plating on probe electrical properties.

Although the resistivity of WRe is greater than W (Table 1), probe needle resistance is inversely related to the cross-sectional area. Thus, the most dramatic changes in probe resistance will occur in the smaller diameter (≤

diameter ( $\leq$  8-mil) WRe-probes. For example, the nominal resistance of a silver plated 5-mil WRe-probe is approximately 47% lower than that of a comparable nickel plated WRe-probe (Table 2).

Silver plated probes are currently being used in the production of probe cards, either in specific positions or as replacements for all nickel plated probes within the epoxy ring.

## **CASE STUDY – Burnt Probe Tips**

A customer of *Probe* & *Test, Inc.*, was experiencing "fried" probe tips (Figure 1) at certain locations within a probe card.

Apparently, the probes were being damaged by a high forcing current. During device testing, a 10amp DC-current was being distributed over all the power and ground probes



Figure 1 - "Fried" probe tip.

of the probe card – approximately 2½-3-amps of current were being forced through each signal probe. As a result, the probe tips were severely damaged and the probe card required frequent repairs resulting in excessive down time. When the signal and ground probes were replaced with silver plated probes, the burnt tip problem was completely eliminated.

The silver plated layer on W and WRe-probe reduces the nominal DC-resistance and inceases current carrying capacity. The benefits of these improvements will be manifested in applications where a high current is forced through the signal and ground probes of a probe card.