BERYLLIUM-COPPER AND PALINEY® – THE "OTHER" PROBE MATERIALS

Tungsten (W) and tungsten-rhenium (WRe) probe needles are used in the fabrication of most probe cards; however, there exist applications for which these materials may not be appropriate, e.g., hybrid device and gold pad probing. For such applications, beryllium-copper (BeCu) and Paliney® probe needles are commonly used.

In the fabrication of BeCu alloys, copper (Cu) is solid-solution strengthened with the addition of beryllium (Be). When these alloys are heat-treated, a uniformly dispersed, coherent Be-precipitate forms that provides a substantial strengthening effect. These two strengthening mechanisms result in alloys that can have strength, stiffness, hardness and electrical resistivity values considerably higher than those of pure Cu. As with W and WRe, the hardness and strength values of BeCu-probes systematically increase with decreased needle diameter.

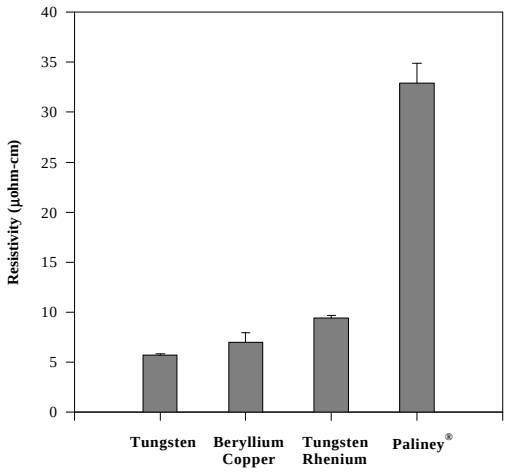
Paliney is an alloy composed primarily of palladium along with small percentages of silver, gold, platinum, and zinc. The nobility of this alloy provides exceptional overall resistance to tarnish and corrosion. Heat treatments can be used to alter the mechanical properties and wear characteristics. The alloying process also results in a material that has an electrical resistivity greater than that of BeCu. In the figure, the nominal electrical resistivity values of 0.010" diameter probe blanks are shown.

	BeCu	**Paliney®**
Elastic Modulus (GPa)	131.5±5.5	121.2±4.9
Vicker's Hardness (kg/mm^2)	288 to 325	320 to 357

Probe needle stiffness and hardness properties.

The elastic modulus of the material directly affects the overall mechanical behavior of a probe during contact pad probing. The BeCu and Paliney modulus values summarized in the table were obtained from three-point flexure tests of probe needles. Since the modulus values of these materials are comparable, the contact forces and scrub lengths of identical BeCu and Paliney probes will be similar (P. Rogan, SWTW '97).

Hardness measures a material's resistance to localized plastic deformation and in general, provides excellent information regarding probe needle wear characteristics. In the table, probe needle microhardness values are summarized. The relatively small differences in hardness suggest that the wear characteristics of BeCu and Paliney-probes will be somewhat similar.



In applications where contact resistance is critical and the high stiffness of W and WRe-probes could damage contact pads, BeCu and Paliney probe needles are used. Both materials offer low contact resistance for better electrical performance, however, they are softer than W and WRe-probes. As a result, they will wear more quickly and may require more frequent replacement.

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ADVANCED PROBING SYSTEMS, INC.
PO BOX 17548 ▲ BOULDER, COLORADO 80308-7548 ▲ PHONE: 303-939-9384 ▲ FAX: 303-939-9032