

Microwave Journal



METAL-CLAD FIBERS WITH SIGNIFICANT WEIGHT SAVINGS AND EMI PERFORMANCE

Micro-Coax is now offering the ARACON® family of metal-clad fibers that combines the conductivity of metal with the strength, light weight and flexibility of Kevlar® aramid fibers. The ARACON fibers are a superior lightweight alternative to traditional nickel-plated copper wire for EMI shielding. Replacing standard wire with ARACON offers significant weight savings without sacrificing EMI performance, as well as other benefits that copper and alloy wires cannot match.

Critical signal paths in aircraft wiring harnesses and cables require shielding to prevent electromagnetic interference (EMI). Braided EMI shields are traditionally made from stan-

dard copper wire. Utilizing ARACON fibers for these braided shields can save substantial weight on an airborne platform. **Table 1** shows examples of braid configurations and the overall weight savings ARACON can offer. The density of the Kevlar aramid fibers is only 1.44 g/cc, vastly superior to copper's 8.90 g/cc. When metal coatings of nickel or silver are added to the ARACON fibers, the density becomes 3.0 to 4.0 g/cc, depending on the material choice and thickness required in the application.

ARACON fibers offer equal or better shielding effectiveness when compared to copper wire at frequencies of 50 MHz and above. At higher microwave frequencies, shielding performance is often better than copper due to the improved braid coverage. To protect against signals below 50 MHz, a hybrid blend of 75 percent ARACON and 25 percent copper wire can be used. This hybrid reduces the transfer impedance of the overall braid, which results in better shielding, as shown in **Figure 1**.

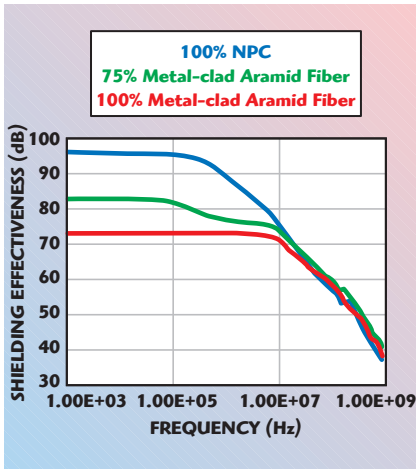
Additionally, the weight savings of the ARACON metal-clad fibers is complemented with higher break strength that is nearly three times

TABLE I

APPROXIMATE WEIGHT SAVINGS (POUNDS) REALIZED WHEN REPLACING NI-PLATED COPPER WIRE WITH AN ARACON BLEND (75%/25%)

Inside Diameter of Over-braid (")	1.00	93	186	465	930
	0.75	48	97	242	483
	0.50	30	61	152	304
	0.25	17	34	85	171
Total over-braid usage per system(!)		1000	2000	5000	10000

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▲ Fig. 1 Shielding effectiveness comparison. (Tokarsky, Edward W., *Case Histories of Aerospace Wire and Cable Uses of Metal Clad Fibers in Harness Overbraids and Shielding*, AEISC, 1999)

that of copper. This eases installations and allows the EMI protection to withstand thousands of flexures during years of high vibration, high stress environments. In fact, ARACON fiber has been tested to more than 10,000 flexes without any degradation in performance. The tensile strength of the

aramid core is 350 Kpsi, much stronger than traditional copper cores, which range from 35 to 95 Kpsi. The high strength of the fiber also affords greater termination reliability. The integrity of standard crimp connections is improved. Soldered connections are used in conjunction with optional silver-plated ARACON.

All the benefits of ARACON performance are achieved due to the properties of the conductors, which are comprised of numerous fine fibers twisted together. Made from aromatic polyamides, ARACON fibers are only 16 microns in diameter. The textile-like properties of the fibers contribute to extremely effective, uniform shield coverage.

THREE FIBER TYPES

Micro-Coax currently offers a Nickel-clad fiber, Silver-clad fiber and salt fog resistant fiber. Nickel-clad fiber is the most economical choice for good overall performance. The Silver-clad fiber is designed for applications in which higher conductivity and solderability are desired. Both weigh 60 per-

cent less than copper wire at equal volume. Providing maximum stability against salt fog and thermal exposure, the salt fog resistant fiber weighs 55 percent less than copper alternatives. All three metal-clad fiber types can be braided on the same equipment used for metal wire, and are available on 3000-foot Wardwell spools or 2000-foot Butt braider bobbins.

For other special applications, Micro-Coax can develop custom ARACON yarns to meet specific design requirements. By varying the metal cladding type and thickness, as well as the base fiber size, Micro-Coax can offer yarns with a wide range of properties. For special applications, the electrical resistance of the fiber can be tailored from 100 to more than 500,000 ohms per thousand feet. Additional information may be obtained by e-mailing techart@micro-coax.com.

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