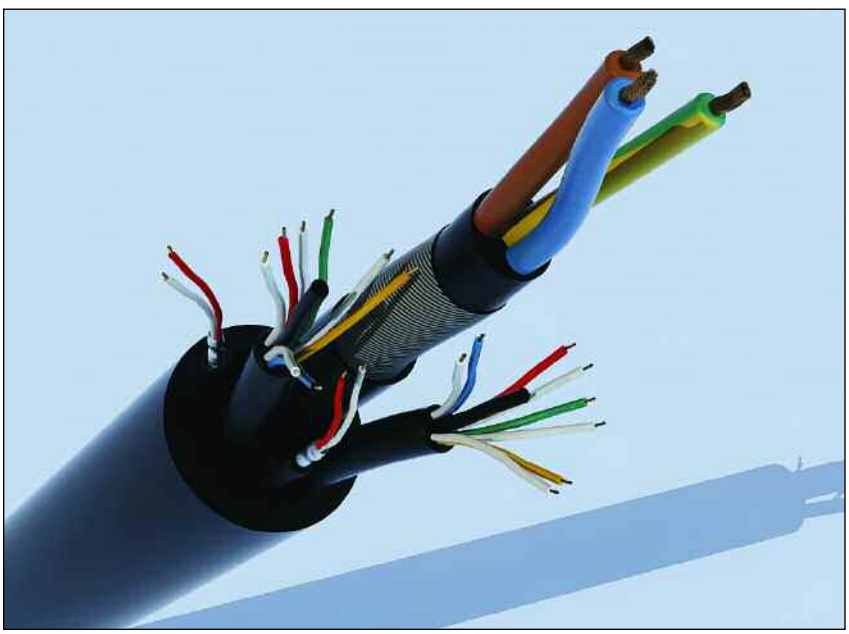
Oxygen-Free For Live Audio...

Myth or reality?

By Marco Piromalli

Often, I am asked about the future of copper cables; seems a bit ironic at times. The honest reply is that I hope my children won't need to rely on the production or sale of cables to put food on their plates! All kidding aside, I believe that the old copper cables will still be essential for a long time. Admittedly, in the future, some applications for copper will become obsolete. For others, copper will be irreplaceable. I am also confident that new applications for copper will arise. I strongly believe that technology itself, on one hand decreases the dependency on copper and on the other it creates it. When I was a youth, we were sure that fiber optics would have completely replaced copper in a decade. Now that I have transitioned from the tour bus to the laboratory and my vision has become clearer, copper still appears to be here, as necessary as ever, even for digital audio and HDTV.



A few applications where copper turns out to be irreplaceable are evident. Speaker cables immediately come to mind and are a good illustration of my point. In traditional live event audio production systems speaker cables are, and will continue to be, essential. Even with the recent popularity of self-amplified speaker systems, copper has simply assumed the form of hybrid signal cables delivering power, audio, and data to many remote amplifiers.

A topic of great debate for those of us "sentenced to life" in the world of live entertainment audio production is that of "Oxygen Free" cables. Being genetically unable to withdraw myself from this discourse, especially of technical nature, I will certainly not refrain now. Instead, let me alternatively propose that it is a futile subject, which requires minimal analysis.

Brushing over the various phases of extractive metallurgy, one must consider that once the copper is obtained, it still requires further purification. A secondary process, which is common to our business, is that of electrolytic purification. The industrially produced metallurgical copper achieves an average purity of 98.5 percent. For many applications, such as an electrical conductor, a higher

try to understand by leveraging some common sense and a bit of technical analysis.

Remember the previous results table. We are speaking of high-conductivity cables; both over 100 percent IACS!

Metal/alloy	Conductivity (IACS %)
Silver	107
Copper	100
Gold	75
Aluminium	75
Brass	27
Bronze	23
Nickel	19
Tin	15
Steel	10

100 percent represents 58 mega siemens per metre conductivity (MS/m) equivalent to 1/58 Ohm/mt resistivity for 1 sq. mm. cable

If we manufacture two cables of identical construction, one utilizing ETP copper and the other OF copper, one might expect that they would perform in an identical way. Taking for granted that a cable, be it signal or power, cannot improve the sound but only prevent its degradation. Can you explain why the ETP cable should in any way "spoil" the sound if it provides 100 percent conductivity? In the non-ideal and the reality of "touring" conditions, with the wear and tear of time, this minute difference may become even more negligible.

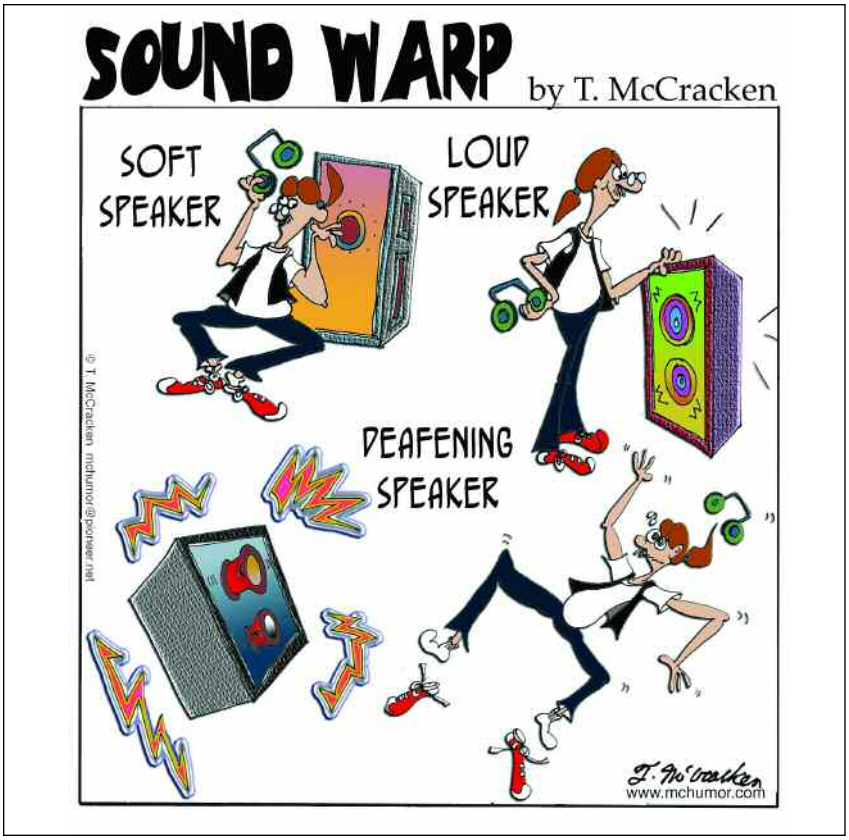
Let me go on even further to say that if we speak about cabling for an esoteric hi-fi system, it is justifiably appropriate to use oxygen-free cables, just for the esoteric philosophy's sake.

In live audio applications, the concept of oxygen-free seems absurd to me, however. I believe one must always bear in mind the application and maintain an equal balance between all of the elements in the entire sound chain. From the source to the loudspeaker, cables included, all components should be of equivalent quality and performance. If I connect a second-rate system with silver cables, it is physically impossible to improve the sound. Now imagine a live touring system. Think of the amplifier hiss. Add each open microphone, capturing the sound it is intended to catch as well as the ambient stage sound. Throw in a ground loop. You are all entitled to your own opinion as to the value of oxygen-free!

Most of the world's leading cable manufacturers exclusively utilize ETP copper for their cable production (audio, video, etc.). It is also true that the cables are used in all types of installations from recording to television studios. Today we can easily affirm that all of the ETP copper produced in Europe, North America, and Japan is of extremely high quality and is the best solution for manufacturing "live" audio and video cables, considering the cost and quality. ■

A copper mine, above.

Mountain movers hard at work, right.



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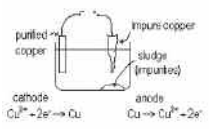
purity of over 99.9 percent is required. The secondary electrolytic purification process proves ideal since one can obtain copper with a purity rating of up to 99.99 percent.

Two types of purified copper may be produced through the electrolytic process. Electrolytic Tough Pitch copper (Cu ETP) is the most widely-used copper for electronic products based on its optimum combination of workability, performance, and economy. ETP is typically at least 99.95 percent pure. Oxygen-Free (Cu OF) can be made up to 99.99 percent pure and is also obtained through electrolysis but requires a more sophisticated process to control the gases in the fusing process to ensure an oxygen-free ambient environment. The secondary purification requirement, which would be extremely costly to obtain through a hydro metallurgical process, can be achieved through the electrolytic process at a fraction of the cost. Today, about 90 percent of all copper produced is purified through the electrolytic process. Below is a brief explanation of the electrical procedure.

Pure copper bars, which make up the cathode, are immersed in an anodic solution. Metallurgic copper plates are placed in the same solution and serve as the anode. A low-voltage current is passed from the anode to the cathode. Over time, a breakdown of the anode takes place with the aggregation of the additional pure copper on the cathode. During this process, the other metals (impurities) are extracted forming anodic mud. The energy consumption is very low since the differential applied is in the region of a few tenths of a volt. The slower the reaction (less voltage), the more pure the resulting copper.



This process is commonly used for the purification of other precious metals such as (silver, gold, platinum, palladium, selenium, and tellurium) all of which the copper mineral contains. Most would not realize that 75 percent of the annual production of silver takes place through the electrolytic purification of copper and lead.

A highly conductive copper is obtained through electrolysis. ETP is typically utilized for the production of electric cables (audio, video, CAT5, telephone, etc.). Cu OF on the other hand is used in the manufacturing of electronic components. The following chart illustrates the resulting conductivity for the two types of purified copper:

Cu-OF – Cu-ETP Copper Comparison	(ETP)	(Oxygen-free)
Silver	.0013	.0012
Sulphur	.0015	.0012
Arsenic	.0006	.0002
Lead	.0010	.0005
Antimony	.0010	.0005
Bismuth	.0001	.00003
Selenium	.0003	.0001
Tellurium	.0001	.00005
Tin	.0004	.0001
Nickel	.0014	.0005
Zinc	.0004	.00005
Oxigen	.0340	.0003
Conductivity (IACS)*	100.7%	101.5%

*abbreviation for International Annealed Copper Standard

As you can see, there are minor differences in the final level of impurities, but truth be told, both types of copper exceed 100 percent in their conductivity rating making them essentially "transparent."

The cables in which we all have interest are used for audio, signal, and power transmission. Many are proclaimed as "oxygen-free" to the prospective buyer. Marketers contend that this distinction, which produces a resultant conductivity in the region of 0.8 percent greater in oxygen-free copper, produces an "audible" (or at least measurable) result. Is this just another gimmick or a technical enhancement that holds water? Let us