

# How your house's brick walls can teach you something about cables

By: A.J. van den Hul CD

Your house's brick walls are made from a collection of bricks of reasonably equal dimensions, built together with cement. The walls are entirely rigid, this undoubtedly to your and your house companions' great appreciation. Cables in essence do not deviate that much from this picture.

Here we also have a collection of parts that among others are connected by means of so called "van der Waals forces". When observing metals in cables these "parts" are named crystals and, instead of cement (in your brick walls), we are dealing with their boundary surfaces. These edge surfaces originate from the cable's production and especially from the time elapsed afterwards.

The production process of conductors involves massive forces on the metal wire and long waiting stops, the latter during which the bare metal remains exposed to the (polluted) open air.

Both mentioned forces and air exposure have quite an influence:

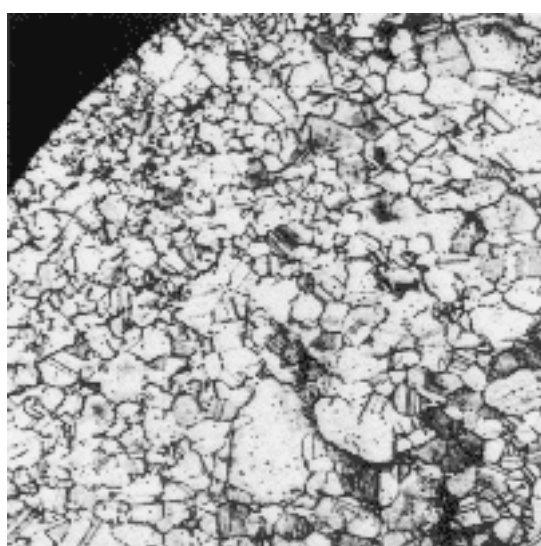
In addition to the mechanically induced formation of new edge surfaces and crystal defects during production, the wire's crystal boundaries during its bare storage and processing are most prone to chemical reaction with oxygen and other airborne chemical compounds which forms chemical layers on the crystal edges.

This affects all metals; those that are closer to the noble metals in the periodic system of elements to a lesser amount than those that are more remote.

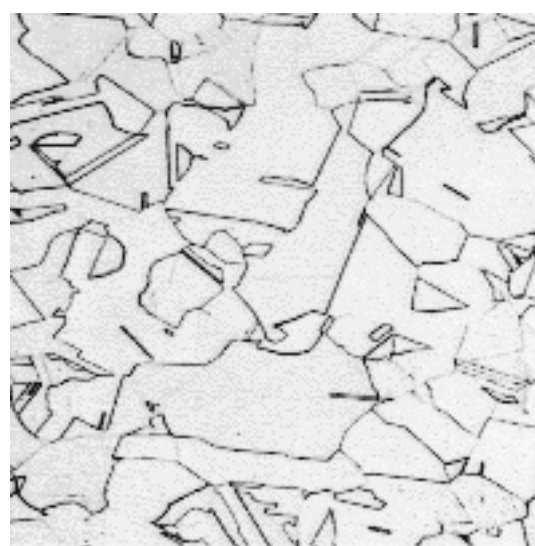
A metal suitable to be used as the conductor in e.g. an audio cable would be rather soft, pliable and ductile, have a low specific resistance, be quite insensitive to corrosion (noble) and be available in large enough amounts (price): regarding its good balance between all properties, of all metals, copper is the most commonly used electrical conductor.

## Your environment's and your own influence on your cables:

Copper is a reasonably suited material since it is soft, quite tough and has a low specific resistance. The formation of internal boundary surfaces due to mechanical and chemical effects however is unfavourable. As a result, the initial quality of signal transfer does not stay forever, but rather is influenced by all kinds of environmental and handling factors. And this is just where the shoe pinches.



*Cross section of a copper wire heavily broken down by bending and chemical corrosion: Severe damage and crystal boundary contamination are discernible.*



*Cross section of an oxygen free pure copper wire as normally found in audio cables: Individual crystals and their boundaries are clearly visible.*

Stating that a cable wouldn't have any influence on sound at all would be the same as saying "I don't care what colour my glasses are; all colours always look equally natural to me".

Or: "I don't care how thick (and long) my garden hose is; the garden sprinkler always works equally well".

From your experience you probably don't agree with these statements.

With the earlier given explanation on important parameters, by now you know that also with audio cables differences are to be expected.

The audio signal transfer through a cable for its most important part is determined by the conductor's properties. With metal conductors besides that, the cable design and insulation materials used clearly take a second role.

With perfect conductors (hence in principle not with metals) latter two aspects suddenly do become important.

## The world's best cable:

The ideal audio signal transmission in a cable can only take place through a material totally clear of internal boundary surfaces where the material neither has mechanical or chemical decline present nor has these encroaching with time.

Your undoubtedly very fine first bike has gone through rust and metal fatigue. And the several cars you may have had during your colourful existence due to same causes also already have ended at the iron foundry.

In their signal transmission behaviour, cables are much more critical than the conductive properties of your old bicycles.

Signals below -100 dB are important in determining the spatial definition in a recording.

With a bad cable these signals are at risk and/or decline into distortion. The harmonic structure is altered, producing more listening fatigue than listening pleasure.

## The way many people listen:

With room reproduction in our country it is a custom not so much to refer to reality but rather to strive for one's own sound image. This including further attempts to "dot the i's and cross the t's" of this idealised image by means of swapping components. With this, cables often are used as the "pepper and salt"; the flavourers and taste enhancers. Nobody can hold this against you, but when using these flavourers to a considerable amount and, above all, in an unconscious manner, it wouldn't be right to boldly deny having touched ye olde salt and pepper set.

Now you know what the consequences can be, it counts to retrieve the trail, realising yourself what truly counts.

## Terminology:

Time (delay) compensation (an in connection with cables often used word) would only matter when you would be able to hear music up to at least 10 MHz. With common audio signals (and a common speed of propagation of the electrical signal in a cable of 200,000 Km/s), a single degree phase shift more or less does not matter. After all, your audio signal traverses 1 meter in 1/2,000,000,000 of a second, which is 5 nanoseconds. Within the same time span in air, sound covers a distance of only 1.72 micrometer. There are still listeners thinking they can detect this, whereas their ears may be as much as 1 mm. out of the straight with their eardrums 4.5 mm. in diameter and positioned at 45 degree angles.

And what to think of your loudspeakers? Their distance to you often is unequal by more than 1 mm.

By the way: 1.72 micrometer is the 1/581-th part of a millimetre. Therefore you don't have to worry too much about that anymore.

Likewise, the so called oxygen free kinds of copper are a nice and fine finding. However....., the copper concerned was only free of oxygen during its production. At your home this for a long time isn't the case anymore. Only the printing on the cable stating "Oxygen Free Copper" still might be free of oxygen.

## How do we deal with our cables:

Electrical signal transfer does not differ that much amongst the metal conductors. What it comes down to is how the material has been treated during its production.

Likewise, the qualities of the insulation material are of large importance; When the isolation can be penetrated by all kinds of (atmospheric) pollutants (this for instance is the case with the often used PVC) you still have not made a progress. Only with sufficient care from the manufacturer, the retailer and yourself (and this goes to great lengths), factors like layout and insulation become important parameters again.

It is of direct importance that you take care that your cable connectors are clean enough. With this you avoid boundary layer problems of the same nature as with the earlier discussed crystal edges. Once a month disconnecting all RCA type connectors and, after turning them around a bit in the contra connector, pressing them in again, directly has more effect. Likewise, keeping your loudspeaker cable connectors clean saves you a lot of annoying sound in the long run.

(At this point we would like to bring the existence of our contact treatment and protection fluid The SOLUTION to your attention.)

Connecting expensive (and especially very thick) cables, in which very thin and often also bad quality mounting wire is applied, to loudspeakers, would be the same as mounting a very thick garden hose to a garden sprinkler with a very small entry opening.

Just drilling out the entry opening a little suddenly causes the entire garden to be a lot more colourful; internally rewiring the entire loudspeaker cabinet all of a sudden causes the same effect.

Sometimes a good combination of listening and active engagement in your audio hobby can lead to amazingly improved

results.

May this article have handed you some ideas to that effect.

**Signed: A.J. van den Hul**

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