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We Visit Mundorf

The Mundorf Company is perhaps best known for its high-performance capacitors and coils for audio applications. The author visited the company and found that it is active in many more audio fields and is hard at work on new products for audiophiles.

By Jan Didden

PHOTO 1: The Mundorf brothers and the author (right) discussing crossover issues over coffee and Kuchen. (All photos by Lou Jansen).

Mundorf is located in Cologne, Germany, just an hour's drive from my hometown. I was cordially greeted by Raimund Mundorf, the founder of the company, and his brother Norbert **(Photo 1)**. Over a coffee with typical German Kuchen, we talked about audio and the history of the company, which started in 1985 when Raimund eventually built a coil winding machine for the custom filter coils he handcrafted one at a time. The machine worked quite well and gradually a business opportunity presented itself. The old machine no longer exists but has been followed by new models producing new and better products.

PHOTO 2: Large contact area of the MCap RXF.

COMPANY BELIEFS

The goal of Mundorf is to design "ideal" components. For example, it is known that generally capacitors have not only a capacitance, but also an ohmic series resistance and a series inductance. Those parasitic attributes have unwanted effects on performance and can cause frequency response deviations and even oscillations in certain applications. The dielectric that is used as isolation in capacitors is also important: Less ideal dielectrics are known to cause absorption and subsequent release of signal energy that can distort the sound.

But there is no free lunch, of course. For example, Mundorf foil caps are often shorter, but larger in diameter, than other caps of equivalent rating. Why? Well, the usual wide, small diameter caps have higher inductance because of the longer pathways of the signal from one connection to the other. On short, large diameter caps, not only is the path shorter, but also there are more windings that appear in parallel, further reducing unwanted inductance. The ESR is also lower because of the wide contact area. You can see this easily in a type MCap RXF cap **(Photo 2)**.

However, short, large diameter caps have many more windings, which means more expensive production. Mundorf believes that the extra cost is worth it for better performance, and its customers seem to agree! The latest trick is using a series connection of two internal caps with reversed internal current flow. That means that to get, say 2µF, you need to build two caps of 4µF in one package, which is four times the material and effort otherwise required. The result, however, is a cap with almost zero inductance: the Supreme series, also available in silver/oil and silver/gold. These are exotic, expensive materials, but they do improve the characteristics of the components.

Over the years, Mundorf crossover components have earned their place among discerning audiophiles and manufacturers alike. For example, if you own some recent B&W speakers, chances are that the crossover is by Mundorf.

COIL CONSTRUCTION

People who know me are aware that I am often critical of claims that seem to have no basis in physical reality. I was, there-

PHOTO 3: Raimund Mundorf giving away (almost) the secret of ultra-low inductance caps.

fore, quite skeptical to hear that Mundorf produces coils with special construction and impregnation treatment to reduce microphonics[1]. But to my amazement, when we went over some third-party measurements, this actually became quite clear! As **Fig. 1** shows, some coils happily resonate mechanically in certain frequency bands and the choice of material, construction, and impregnation can help to suppress this effect.

You can argue that the microphonics as such would not be audible with the component mounted inside an enclosure. But remember: that mechanical resonance needs energy, and that energy must come from somewhere, and it can only come from the signal passing the components! The specific effect on the sound depends very much on the particular place in the circuit, but it is clear that this effect distorts the signal and thus the sound.

The expertise Mundorf built up with home hi-fi components also allowed it to branch out to car audio. Notable here are very high value capacitors to hold up the car's supply for those watt-hungry systems—electrolytics that can deliver peak currents of several hundred amperes. And, oh yes, they should be mounted on a heatsink. . . and if you need a 300A 13.8V DC supply to demo your car stereo at home, Mundorf have those, too.

TUBECAPS

One of the disadvantages of electrolytics is that they age and lose capacitance over their lifetime. The aging is accelerated with elevated temperatures often encountered in (tube) power amps. The solution is a foil cap, but traditionally foil caps have been very, very bulky for the required capacitances and voltage ratings for tube amps and supplies and consequently are quite expensive. Using a very thin, rough foil can increase capacitance for a given volume, but the reliability may suffer because of production defects and foil puncturing.

With typical creativity Mundorf attacked the problem and solved it: Accept the fact that after production the caps may have some shorted spots, but then use a special process that "burns off" a small conductor area around the short to restore isolation.

This self-healing effect is not new, but as far as I know has not been used in this application area. The result is a capacitor that is roughly equal in volume to an electrolytic but with no aging, improved reliability and less series resistance so it functions much better and reliably in (tube) power amps and supplies. It is non-polar to boot, so is an excellent high voltage, high capacitance coupling cap.

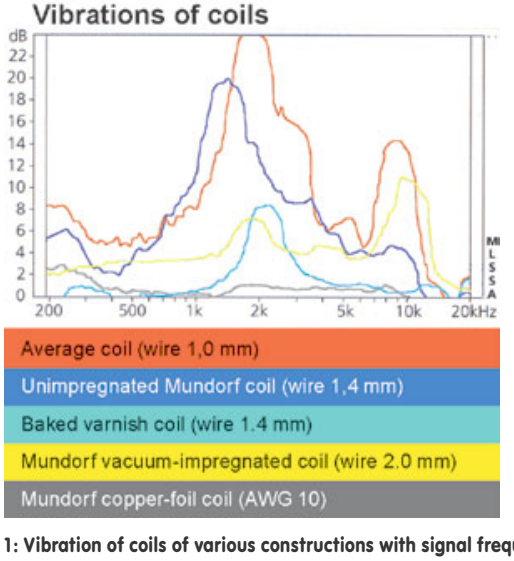

FIGURE 1: Vibration of coils of various constructions with signal frequency.

AMT DRIVERS

In a corner of the lab I spied an unknown object, which turned out to be a prototype Air Motion Transformer (AMT) speaker driver **(Photo 4)**! Many readers remember Oskar Heil's famous Heil speakers of the 70s with the patented AMT mid/high driver, which consists of a pleated diaphragm with a conductor etched on it, placed in a strong magnetic field. As the signal current flows across the diaphragm, alternate sides of the pleats are attracted to and repelled by each other: the pleats open and close in a musical rhythm and move the air outward and inward, generating a sound field.

PHOTO 4: The Mundorf Air Motion Transformer diaphragm.

Over the past three years, Mundorf pushed this principle toward the next level in terms of rethinking and researching the designs leading to the award of new patents. Today the company produces a wide range of varied AMT drivers for OEMs, but I wouldn't be surprised if they also became available to individual builders. The measurement graphs I saw in Mundorf's own sound dead room were impressive.

I am not surprised that Mundorf is so successful in its endeavors. The company's employees, who obviously enjoy what they are doing, are tinkerers in the right sense of the word, looking for creative solutions to problems. Being a family business, Mundorf has the flexibility to do what it thinks is worthwhile without the immediate worry of the shareholders. Ultimately, that benefits all of us audiophiles. *aX*

More info at www.mundorf.com

FOOTNOTE

1. Strictly speaking, the effect described here is not microphonics. Microphonics means that the component picks up a signal from vibrations (air or mechanical); in this case I describe a component generating vibrations from a signal. Maybe we should call this speakerphonics?