CARDAS AUDIO

Cable Break-In

This article was kindly donated by George Cardas

There are many factors that make cable break-in necessary and many reasons why the results vary. If you measure a new cable with a voltmeter you will see a standing voltage because good dielectrics make poor conductors. They hold a charge much like a rubbed cat's fur on a dry day. It takes a while for this charge to equalize in the cable. Better cables often take longer to break-in. The best "air dielectric" techniques, such as Teflon tube construction, have large non-conductive surfaces to hold charge, much like the cat on a dry day.

Cables that do not have time to settle, such as musical instrument and microphone cables, often use conductive dielectrics like rubber or carbonized cotton to get around the problem. This dramatically reduces microphonics and settling time, but the other dielectric characteristics of these insulators are poor and they do not qualify sonically for high-end cables. Developing non-destructive techniques for reducing and equalizing the charge in excellent dielectric is a challenge in high end cables.

The high input impedance necessary in audio equipment makes uneven dielectric charge a factor. One reason settling time takes so long is we are linking the charge with mechanical stress/strain relationships. The physical make up of a cable is changed slightly by the charge and visa versa. It is like electrically charging the cat. The physical make up of the cat is changed by the charge. It is "frizzed" and the charge makes it's hair stand on end. "Teflon Cats", cables and their dielectric, take longer to loose this charge and reach physical homeostasis.

The better the dielectric's insulation, the longer it takes to settle. A charge can come from simply moving the cable (Piezoelectric effect and simple friction), high voltage testing during manufacture, etc. Cable that has a standing charge is measurably more microphonic and an uneven distribution of the charge causes something akin to structural return loss in a rising impedance system. When I took steps to eliminate these problems, break-in time was reduced and the cable sounded generally better. I know Bill Low at Audioquest has also taken steps to minimize this problem.

Mechanical stress is the root of a lot of the break-in phenomenon and it is not just a factor with cables. As a rule, companies set up audition rooms at high end audio shows a couple of days ahead of time to let them break in. The first day the sound is usually bad and it is very stressful. The last day sounds great. Mechanical stress in speaker cables, speaker cabinets, even the walls of the room, must be relaxed in order for the system to sound its best. This is the same phenomenon we experience in musical instruments. They sound much better after they have been played. Many musicians leave their instruments in front of a stereo that is playing to get them to warm up. This is very effective with a new guitar. Pianos are a stress and strain nightmare. Any change, even in temperature or humidity, will degrade their sound. A precisely tuned stereo system is similar.

You never really get all the way there, you sort of keep halving the distance to zero. Some charge is always retained. It is generally in the MV range in a well settled cable. Triboelectric noise in a cable is a function of stress and retained charge, which a good cable will release with both time and use. How much time and use is dependent on the design of the cable, materials used, treatment of the conductors during manufacture, etc.

There are many small tricks and ways of dealing with the problem. Years ago, I began using Teflon tube "air dielectric" construction and the charge on the surface of the tubes became a real issue. I developed a fluid that adds a very slight conductivity to the surface of the dielectric. Treated cables actually have a better measured dissipation factor and the sound of the cables improved substantially. It had been observed in mid eighties that many cables could be improved by wiping them with a anti-static cloth. Getting something to stick to Teflon was the real challenge. We now use an anti-static fluid in all our cables and anti-static additives in the final jacketing material. This attention to charge has reduced break-in time and in general made the cable sound substantially better. This is due to the reduction of overall charge in the cable and the equalization of the distributed charge on the surface of conductor jacket.

It seems there are many infinitesimal factors that add up. Overtime you find one leads down a path to another. In short, if a dielectric surface in a cable has a high or uneven charge which dissipates with time or use, triboelectric and other noise in the cable will also reduce with time and use. This is the essence of break-in

A note of caution. Moving a cable will, to some degree, traumatize it. The amount of disturbance is relative to the materials used, the cable's design and the amount of disturbance. Keeping a very low level signal in the cable at all times helps. At a show, where time is short, you never turn the system off. I also believe the use of degaussing sweeps, such as on the Cardas Frequency Sweep and Burn-In Record (side 1, cut 2a) helps.

A small amount of energy is retained in the stored mechanical stress of the cable. As the cable relaxes, a certain amount of the charge is released, like in an electroscope. This is the electromechanical connection.

Many factors relating to a cable's break-in are found in the sonic character or signature of a cable. If we look closely at dielectrics we find a similar situation. The dielectric actually changes slightly as it charges and its dissipation factor is linked to its hardness. In part these changes are evidenced in the standing charge of the cable. A new cable, out of the bag, will have a standing charge when uncoiled. It can have as much as several hundred millivolts. If the cable is left at rest it will soon drop to under one hundred, but it will takes days of use in the system to fall to the teens and it never quite reaches zero. These standing charges appear particularly significant in low level interconnects to preamps with high impedance inputs.

The interaction of mechanical and electrical stress/strain variables in a cable are integral with the break-in, as well as the resonance of the cable. Many of the variables are lumped into a general category called triboelectric noise. Noise is generated in a cable as a function of the variations between the components of the cable. If a cable is flexed, moved, charged, or changed in any way, it will be a while before it is relaxed again. The symmetry of the cable's construction is a big factor here. Very careful design and execution by the manufacturer helps a lot. Very straight forward designs can be greatly improved with the careful choice of materials and symmetrical construction. Audioquest has built a large and successful high-end cable company around these principals.

The basic rules for the interaction of mechanical and electrical stress/strain variables holds true, regardless of scale or medium. Cables, cats, pianos and rooms all need to relax in order to be at their best. Constant attention to physical and environmental conditions, frequent use and the degaussing of a system help it achieve and maintain a relaxed state.

A note on breaking in box speakers, a process which seems to take forever. When I want to speed up the break-in process, I place the speakers face to face, with one speaker wired out of phase and play a surf CD through them. After about a week, I place them in their normal listening position and continue the process for three more days. After that, I play a degaussing sweep a few times. Then it is just a matter of playing music and giving them time