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## **CREATING THE ULTIMATE COPPER:**

### **Oyaide New 102 SSC Conductor:**

For many years, we produced our cable masterpieces using a very high quality material made by Furukawa Electric Group called PCOCC-A. It was the basis of most Oyaide cable products and, for us, a source of pride that they were 100% Made in Japan. However, at the beginning of 2013, Furukawa suddenly announced the discontinuation of PCOCC-A. This announcement was earth-shattering news not only for Oyaide, but also for manufacturers worldwide who had come to rely on the high value and dependable performance of PCOCC-A.

After deep contemplation of the available options, many of which required unacceptable compromises, we decided that the best course of action was to make our own proprietary, brand new conductor. Taking on this immense challenge is a reflection of the spirit we bring to our creations - to constantly strive to make them the best they can possibly be, while offering the highest value and performance to our customers. With this philosophy in mind, we invested over a year and a half of research and development into our new revolutionary conductor – 102 SSC.

We began our journey by digging deeply to define the new concept. We decided that the right approach would be to "produce copper of the highest quality ever made using the most advanced technologies available that would be available without interruption." The advantages of developing our own custom conductor are many. Previously we relied on available materials such as PCOCC-A and LC-OFC, but we realized that given the changing social situation, the small size of the Hi Fi Audio market and the inefficiency and uncertainty of relying on others' for critical materials, we needed to create our own "super" copper using more commonly available copper as a base material to insure a long term stable supply. It also allows us to maintain our 100% Made in Japan signature. Finally, by investing in the time and research to produce our own conductor, we have complete control of every aspect of design, quality and ultimate sonic performance. 102 SSC will allow us to further extend our technological lead in the Hi-Fi market.

The copper base material for 102 SSC is refined in Japan and conforms to the elite Japanese JIS C1011 industrial standard. Compared to other JIS C1011 coppers, we specified only pure virgin copper that does not contain any recycled material. This eliminates any chance of legacy contamination and impurities. While acceptable performance can be achieved with recycled copper, the extra effort required for using virgin copper produces not only a superior product but also a degree of pride, which comes from knowing we are using the purest possible approach. Even though assay testing reveals no quantitative difference between pure virgin and recycled C1011 copper, we felt that even the remotest possibility of contamination was unacceptable. Our aim is always to achieve the maximum possible performance and never to settle for "good enough".

Our virgin copper base material is delivered to one of Japan's most advanced wire drawing facilities where it is first rolled into a rod and then brought to a fineness of about 1mm in numerous stages to minimize stress and deterioration of the crystal structure of the copper. In typical copper wire drawing processes, impurities are removed by acid cleaning (pickling). However, the cleaning liquid tends to leave a residue, which affects performance and does not succeed in completely removing all impurities. For our 102 SSC copper, we have instead employed mechanical peeling – a very precisely controlled process that removes 100% of impurities. Our use of this more costly process, rarely seen in audio cable production, demonstrates our commitment to bring you products of the highest possible quality.

After mechanical peeling, the wire is annealed to remove all stresses and strains induced by the drawing process. A great deal of skill and dedication went into determining the exact time and temperature specifications required to maintain maximum mechanical strength, highest electrical conductivity, and optimal recrystallization. Commonly used bell type annealing leaves a residue of soot. To avoid this, we adopted 'in-line' electric annealing. Test results after this process, show an incredible conductivity level of 102.3 % IACS. This result is the namesake for 102 SSC.

After numerous inspections, the annealed copper wire is vacuum packed to prevent any oxidation. It must then be shipped immediately to the fine drawing and stranding facility. We specify that this must occur within two days. It is rare to impose such a strict timetable on shipment of bare copper wire, but we have done so to prevent degradation of the conductor surface. We schedule the process of fine drawing to occur within two days of arrival for the same reason. As a result, our conductor is guaranteed to remain preserved in its purest form between the different stages of development.

The standard of precision that we at Oyaide are attempting to achieve may be seen to be beyond all common sense. Our vision was to create a conductor that transcended standard technology and entered the realm of art—a conductor whose quality could be compared in its field with the likes Patek Philippe and Vacheron Constantin in theirs. Key to achieving this was our focus on the basic theory that "most electrical signal travels through the conductor's surface." To achieve the quality we sought, we knew that that the facility conducting the fine wire drawing would have to be best in the world. To this end, we engaged Sanshu Electric Wire Company in Aichi Prefecture. Without their highly skilled artisans and their commitment to pushing the limits of what is technologically possible 102 SSC would not have been born.

Following the success of our FTVS-510 and FTVS-910 pure silver wires, we imagined applying a similar approach to our new copper wire. Drawing by means of natural diamond dies and use of the 'skin pass process' imparts a mirror like finish to our silver wires. (Even though the wire is annealed in an inert gas, some minuscule amount of oxidation remains. Perfect surface dies are used to skim away all traces of oxidation.) We already understood through extensive testing that this level of surface perfection directly results in pure transmission of extremely high frequencies used in digital audio signals but also contributes to perfectly balanced analogue sound signals. Lack of homogeneity of the wire surface will give rise to high frequency noise which in turn reflects negatively on signal to noise ratio and playback accuracy. By applying the 'skin pass process', a high degree of surface uniformity over the entire length of wire is achieved.

In our collaboration with Sanshu Electric Wire Company, we embarked on a quest to improve machining accuracy and the polishing process. Dies normally used in drawing wire are made from synthetic diamonds for cost and efficiency. We adopted the use of natural diamond dies which are far more costly, but which yield more uniform volume reduction with reduced stress and improved lubricity. With natural diamond dies, we can set targets of  $\pm 1\mu\text{m}$  for the outer diameter tolerance of the wire. This is an incredibly precise specification among wire producers. The adoption of natural diamond dies, and associated technologies to achieve this level of precision in outer diameter are the result of Sanshu Electric's many years of experience. They are able to monitor tolerances 1600 times per second over the entire length of a single line of wire.

Natural diamond dies are very delicate and require constant maintenance. The inner hole of each die is polished after each operation with diamond powders of less than  $1\mu\text{m}$ . The 102 SSC dedicated dies all have strict maximum limits for time-hours and the distance/length during continuous run. Before being set in place, dies are always checked for wear, cracking and chipping by microscope. If there is any problem

whatsoever, they will be replaced immediately. The frequency of replacement is 10 to 20 times that of normal dies, but this is necessary to achieve the level of quality we require. In this way we have created a copper wire whose surface structure is far superior to all others. With our outer diameter accuracy of  $\pm 1\mu\text{m}$  far exceeding the  $\pm 8\mu\text{m}$  in JIS C 3102 standards for conventional copper wires, we decided to call our process Special Surface Copper. Thus our special copper, with the world's finest surface, quality is called 102 SSC.

For the final annealing process, to remove stresses induced by fine drawing, custom annealing methods, including optimal time and temperature settings for each diameter of wire produced, were chosen based upon extensive experiments and study. Our long journey to create a new conductor is nearing its end.

The final determining factor in designing our new wire is determining the stranding method. At Oyaide, we have adopted many types of wire stranding and cable structures depending on the product type. These include: bunched stranding, concentric stranding, uni-lay stranding, rope lay stranding, cylindrical structure and solid core. We engaged Sanshu Electric's artisan craftsmen to further reflect on our established methods and together we developed a new, higher-spec technology.

For the first time in history, 3E (3 Element) stranding, developed and patented by Sanshu Electric Wire, has been adopted for an audio cable. 3E stranding combines strands of three different diameters to increase the density of the wire by decreasing the spaces between strands. This difficult to achieve stranding is only possible by means of Sanshu Electric's severe production controls. No other company in the world possesses the skill set required to achieve perfect lay 3E stranding. The result is a conductor with a smaller outer diameter than the same gauge wire made with identical individual strands, plus a more accurate, stable and perfectly circular cross section with uniform strength and super high audio performance characteristics throughout the entire cable production.

The extreme care taken in the stranding process is another example of Oyaide's commitment to excellence, to delivering the highest level of Japanese craftsmanship with pride. Sanshu Electric Wire's collaboration was essential to the creation of the 102 SSC conductor. By applying extreme focus and deep insight, and by our willingness to depart from common practices we were able to produce an entirely new class of copper.