



## Electrical Conductivity of Copper

Welcome to Yamato Gokin Co., Ltd.'s 6th monthly e-newsletter, and our first English-language edition.

For this month's newsletter, we've changed the concept slightly to share with you some fun facts associated with copper. When choosing the appropriate copper alloy for industrial use, a variety of special characteristics such as hardness, anti-corrosion, electrical conductivity, thermal conductivity, and sliding properties are taken into consideration. In fact, many of you who are reading now are probably aware of copper's various properties and characteristics. Within those special characteristics, electrical conductivity is one of the most important.

In general, pure copper has the best electrical conductivity of all metals, but pure copper is a soft metal that is not always suitable for use in industrial parts. For that reason, metals such as aluminum and chromium are mixed with pure copper in order to increase its hardness. However, this in turn lowers the electrical conductivity of the mixed metal. This raising of one property and the subsequent lowering of another is a commonly known trade-off when manufacturing alloys.

The ease at which electricity flows through metal is demonstrated through an electrical conductivity percentage known as "IACS." The materials manufactured at Yamato Gokin, for example, have a standard of 75 IACS% and above for our copper chromium alloy and 45 IACS% and above for our copper beryllium 50 alloy.

By the way, did you know that there is a copper material that has an electrical conductivity of about 102%? We mentioned that pure copper has the best electrical conductivity, but pure copper that exceeds pure copper?! Politicians and celebrities often exaggerate by saying "I'll give 200%" or "I promise 1000%," but for materials and products used for industrial use, over 100% is a little unheard of, right? With time, the world has invented the ability to exceed 100%.

In 1913, the United States National Bureau of Standards analyzed pure copper collected from 14 copper smelters and wire manufacturers in the United States, leading the U.S Department of Commerce to establish the International Annealed Copper Standard. It was then established internationally as a volume resistivity of  $1.7241 \times 10^{-8} \Omega \text{m}$  equaling 100 IACS%.

In other words, the standard of 100% conductivity was set for the highest purity of copper that could be refined by machining equipment of that time, and with subsequent technological progress, it became possible to refine an even higher purity of copper. As a result, the copper used in industrial production and manufacturing today can have an electrical conductivity of over 100%. A world with possibilities of more than 100% created by advances in time and technology. Isn't it strange?

By the way, copper (Cu) is often regarded as a representative metal for its ease of electrical conductivity, but it is not the real champion. Actually, silver (Ag) has a lower resistivity and an electrical conductivity of over 106%. Its price is nearly 100 times higher than the current market price of copper.

*Thank you for reading our e-newsletter and for your continued support. How did you like it?*