August 24, 2020

News Release

SANYO SPECIAL STEEL

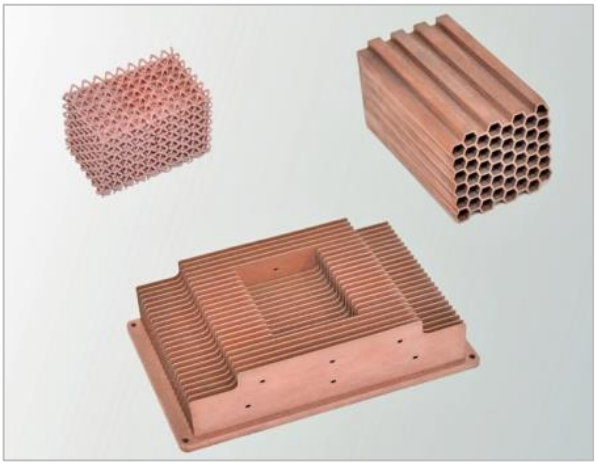
Commercialization of a New Copper Alloy Powder Ideal for Laser Additive Manufacturing

- Achieving both high relative density and electro-thermal conductivity -

Sanyo Special Steel Co., Ltd has developed and is bringing to market a new copper alloy powder ideal for additive manufacturing.

Pure copper powder is thought to have difficulty obtaining high-relative-density moldings by widely used laser additive manufacturing methods. Using copper alloy powder enables the manufacture of high-relative-density moldings, even with laser additive manufacturing. However, this sacrifices copper's characteristic electro-thermal conductivity.

Our new copper alloy powder has achieved both high-relative-density additive manufacturing and electro-thermal conductivity similar to that of pure copper. It can be used for producing highly functional copper components with complex shapes by laser additive manufacturing.



【Examples of moldings by laser additive manufacturing】

Difficulties of Using Pure Copper in Laser Additive Manufacturing

Pure copper has excellent electrical and thermal conductivity, and is used in a wide variety of applications. In particular, electronic and electrical components and heat exchangers are often processed into complex shapes, and additive manufacturing is expected to help make it easier to create shapes close to the finished product.

However, the laser absorption rate of pure copper is much lower than that of other metals, which makes it difficult for the material to absorb thermal energy from the laser. In addition, the high thermal conductivity of copper prevents the heating required to melt the material, as the heat energy from the laser diffuses rapidly. Therefore, it is difficult to produce high-relative-density pure copper components by laser additive manufacturing.

The solid solution method, in which other alloy elements are dissolved into the copper matrix, increases the laser absorption rate of copper. The amount of alloying element that can be dissolved into the copper matrix (the solid-solubility limit) is different for each element, so selecting an element with a high solid-solubility limit increases the laser absorption rate. However, this sacrifices the electrical and thermal conductivity of the moldings.

Developing a New Copper Alloy Powder Ideal for Laser Additive Manufacturing by Optimizing Alloy Composition

The gas atomization method used in our metal powder production, in which a molten metal is rapidly solidified using a high-pressure inert gas (argon, nitrogen, etc.), can even dissolve amounts of alloy elements with low solid-solubility limits into a copper matrix via supersaturation.

By supersaturating a large amount of alloy element with a low solid-solubility into the copper matrix, the laser absorption rate is greatly improved. In addition, the electro-thermal conductivity of moldings are restored to a level close to that of pure copper, owing to the supersaturated alloy element being discharged from the copper matrix by heat treatment, and can also improve strength.

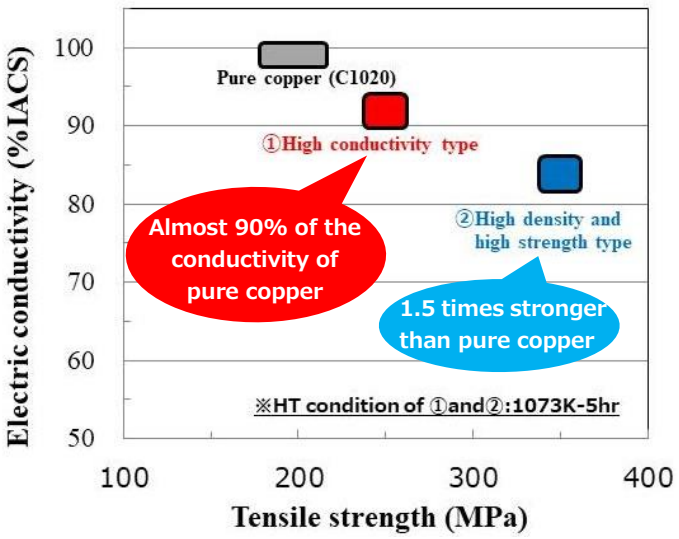
Based on these above concepts, we optimized the alloy composition of copper alloy to be suitable for laser additive manufacturing. As a result, we developed a new copper alloy powder that has a high laser absorption rate and can achieve electro-thermal conductivity similar to that of pure copper, and strength exceeding that of pure copper by heat treatment of moldings.

We Can Supply Copper Alloy Powders to Suit Your Needs

We can provide copper alloy powder to suit your application, such as prioritizing conductivity or density/strength. They all can be used to produce high-relative-density moldings by laser additive manufacturing.

The moldings using our copper alloy powder have approximately 90% the conductivity of cast pure copper if using powder that prioritizes conductivity, and more than 1.5 times the strength of cast pure copper if using powder that prioritizes density/strength.

Our new copper alloy powder enables high-density laser additive manufacturing with excellent electro-thermal conductivity and strength, making it easy to produce moldings with complex shapes that are difficult with traditional casting and stretching methods. This is expected to optimize the shapes of parts such as electronic and electrical components and heat exchangers, as well as create new markets in the automotive, aerospace, and medical fields.



In addition to our gas atomization facilities that are capable of producing high-quality spherical metal powders, we have two state-of-the-art metal 3D printers and a non-destructive inspection system (X-ray CT scan). Besides the copper alloy powder mentioned above, we are actively working to provide total support for our customers' development, along with providing ideal metal powders for additive manufacturing through the development of alloy composition ideal for additive manufacturing, establishing manufacturing processes that maximize material properties, and utilizing rapid material evaluation systems. We will continue to focus our efforts on developing new products and technologies, providing solutions that utilize materials and technology in order to improve the competitiveness of our customers.

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