Name	Job Title	Area of Expertise
YAMAMOTO Masataka	Assistant Professor	Materials Science of Metals

1. Main Research Topics

① Balancing electrical conductivity and mechanical strength in Copper alloys

With the recent advancement of electronic devices, the development of high-performance copper alloys, which serve as the base material, has become an important technology. In particular, the development of copper alloy wires with higher strength and conductivity is desired for applications such as lead wires, conductive spring materials, and DVD pickup wires. Generally, there is a trade-off between the conductivity and strength of copper alloys. The copper alloy currently in use is Cu-Be (copper-beryllium) alloys, but concerns about the toxicity of beryllium and its environmental impact have raised the need for alternative materials. I am focusing on Cu-Ti (copper-titanium) alloys, which have lower conductivity than Cu-Be alloys, and conducting research on techniques to improve conductivity while maintaining strength. Specifically, I am investigating the effects of adding third elements and aging heat treatments on the conductivity and strength of Cu-Ti alloys.

② Fabrication of lightweight, high-strength metal-based composite materials

One of the important issues to meet the demand for energy saving is to reduce the weight of transportation equipment. We are working on the development of metal-based composite materials with high strength by combining aluminum alloys and magnesium alloys with ceramic fibers and particles such as silicon carbide and alumina. In order to achieve the ideal strength, it is necessary to reduce casting defects. The purpose of this study is optimization of the casting process for fabricating the ideal metal-based composite materials.

③ Increasing the strength and workability of magnesium alloys

Magnesium is the lightest of all practical metals, but its low strength makes it unsuitable for use as a structural material. Furthermore, increasing its strength reduces its workability, limiting its range of application to small components. To resolve this dilemma, I am working to refine the crystal grains of magnesium alloys by devising casting methods, aiming to achieve both strength and workability.

2. Keywords

Copper alloy, Electrical conductivity, Mechanical strength, Magnesium alloy, Crystal refinement

3. Remarks and Websites

Although copper has a longer history than iron, systematic knowledge about the mechanisms of precipitation strengthening and electrical conductivity has yet to be developed. With the trend toward more advanced electrical equipment in automobiles and smaller electronic devices, the results of this research are expected to make a significant contribution to these areas.

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