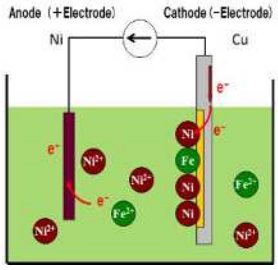
Name	Job Title	Area of Expertise
YANAI Takeshi	Associate professor	Magnetic Materials and Their Applications

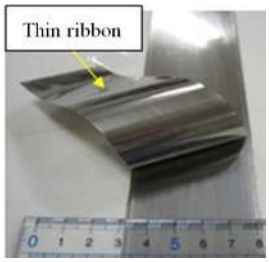
1. Main Research Topics

① Development of soft and hard magnetic thick films prepared using electroplating and electroless plating methods



We are studying preparations of magnetic materials for small magnetic devices using electroplating and electroless plating methods. Our research focuses on improving their magnetic properties and studying effective additives into the plating baths. Our laboratory can produce magnetic films with thicknesses in the range of approximately 1 to 20 μm in just a few minutes.

② Fabrication of soft magnetic ultra-thin ribbons



Power semiconductors such as SiC and GaN have become more widely used, leading to increases in the power and operating frequency of power electronics devices. Magnetic materials are essential components in these devices, used as core materials in transformers and reactors. We are developing soft magnetic materials with high saturation magnetic flux density for high-power applications.

③ Computer simulation of soft magnetic properties

We are investigating the application of induced magnetic anisotropy using external stress to improve high-frequency magnetic properties. As part of this investigation, we are developing a computer simulation method for studying magnetic properties. Based on micromagnetic theory, we are using parallel calculations with GPUs to perform multi-element analysis and determine magnetic properties in a short time.

④ Others（Novel electrolyte）

In wet processes such as electroplating and electroless plating, water is often used as a solvent. As water is decomposed to H_2 and O_2 gases when high voltage is applied during electroplating, some elements are difficult to obtain from an aqueous solvent. To address this issue, we are investigating the preparation of magnetic films using deep eutectic solvents. Additionally, we are also investigating the plating from solid electrolytes (gel plating) to reduce waste liquid.

2. Keywords

Magnetic films, electroplating, electroless plating, high frequency, power electronics, computer simulation

3. Remarks and Websites

With the rapid progress of power electronics technologies, there has been growing concern for several years now about the shortage of suitable magnetic materials for these applications. Recently, these concerns have become even more pronounced, and we strongly feel the increasing demand. We are working hard to meet these expectations through materials development in several areas, including metallic magnetic thin ribbons for high-frequency use, small magnetic films for medical applications, and soft magnetic films for sensors and other devices. If any of these topics interest you, please feel free to reach out to us.

researchmap: https://researchmap.jp/read0125661
Laboratory: http://www.eee.nagasaki-u.ac.jp/labs/magnet/index.html