

Electronics

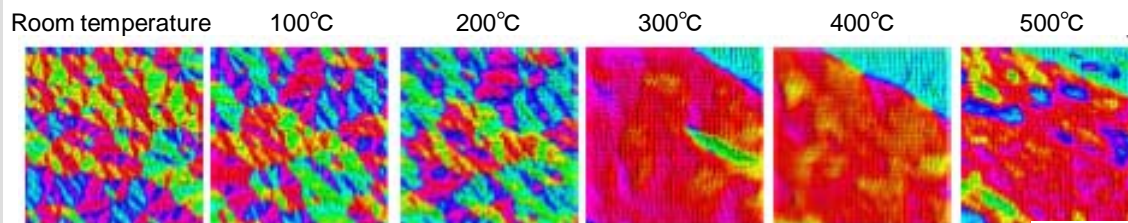
Central Research Laboratory
Advanced Measurement and Analysis Center

Hitachi, Ltd., web site [21st Sep 2010 News Release] <http://www.hitachi.com/New/cnews/100921c.html>

Observation of magnetic domains in cobalt single crystal at 500°C with spin-polarized scanning electron microscopy

■ Changes observed with Spin-SEM in the magnetic domains of a cobalt single crystal as a function of temperature

Magnetization vector map: Direction of magnetization indicated by colors



Significant changes occur in the magnetic domain between 200°C and 300 °C, and the formation of sub-micron-order magnetic domains can be observed within the larger magnetic domain between 400°C and 500°C.

Technology was developed to observe magnetic domains (the region where the spin direction is the same) under high temperature conditions in a magnetic field with spin-polarized Scanning Electron Microscopy (spin-SEM).

By applying the technology developed, the temperature conditions for observing magnetic domains in a sample can be heated up to 500°C when using only the heating unit, and up to 250°C when used in combination with a function to apply a magnetic field of up to 1,000 Oersteds (Oe). This technology is useful in investigating precisely the high-temperature characteristics of magnet devices such as magnets and HDDs.

Spin: the smallest unit representing magnetic property.

■ Characteristics

This technology observes the magnetic domains of magnetic materials at a high temperature of at 500°C with micrometer resolution. Further, a magnetic field can also be applied during observation. To enable this, the following two technologies were developed.

- ① A "sample heating unit" which doesn't emit gases that might contaminate the sample when overheated.
- ② A "magnetic field emitting unit" which allows a magnetic field to be applied to the sample without affecting the measurement signals.

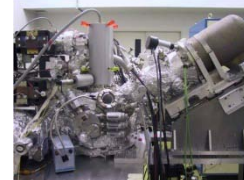
■ Applications

- ① Enhancement of high-temperature properties of magnets
- ② Evaluation of the thermal stability of HDD

■ Conference presentation

These results were presented at the 17th International Microscopy Congress, held from 19th to 24th September 2010 in Rio de Janeiro, Brazil.

■ A word from the development team



Spin-SEM is an observation technique first announced by Hitachi in 1984. R&D is being conducted to further enhance resolution.