Awards

2009/11/27

Winner of the 20th Tsukuba Award

The 20th Tsukuba Prize Award Ceremony was held at the Tsukuba International Congress Center on Friday, November 20, 2009.

Research Group Leader Shinji Yuasa

The Tsukuba Prize is sponsored by the Ibaraki Science and Technology Foundation and Tsukuba Science Academy, and was established with the aim of contributing to the promotion of science and technology by honoring those engaged in research in science and technology within Ibaraki Prefecture who have achieved outstanding research results that have been recognized worldwide. This time, Shinji Yuasa, Research Group Leader of the Spintronics Group in the Electronics Research Department, received the award jointly with Professor Yoshishige Suzuki of the Graduate School of Engineering Science at Osaka University (Visiting Researcher at the National Institute of Advanced Industrial Science and Technology).

[Award-winning theme] "Realization of giant tunnel magnetoresistance effect in MgO tunnel elements and its industrial application"

[Award Details]

A magnetic tunnel junction (MTJ) element is an element in which an extremely thin insulating layer (called a tunnel barrier) with a thickness of less than a few nanometers is sandwiched between two ferromagnetic metal layers. The electrical resistance of the MTJ element changes when the magnetization directions of the ferromagnetic layers on both sides are parallel or antiparallel to each other. This phenomenon is called the tunnel magnetoresistance (TMR) effect, and the rate of change in electrical resistance (called the MR ratio) is a performance indicator for applications. The TMR effect can be applied to magnetic sensor elements and memory elements, and is therefore a key technology in the new field of electronics known as "spintronics," which utilizes electron spin.

Based on their theoretical prediction, Yuasa and Suzuki conducted experiments based on the theory that a very large MR ratio could be obtained by using crystalline magnesium oxide (MgO) instead of the conventional amorphous aluminum oxide (MR ratio of several tens of percent) for the tunnel barrier, and in 2004 they achieved a huge MR ratio of 180% at room temperature. Furthermore, in 2005, they succeeded in developing mass production technology for crystalline MgO-MTJ elements in collaboration with a manufacturing equipment manufacturer. After that, product development using this huge TMR effect was carried out, and in 2007 it was put to practical use as a magnetic head (MgO-TMR head) for hard disk drives (HDDs), which has contributed greatly to the recent dramatic increase in HDD capacity. Furthermore, this technology is expected to lead to revolutionary power savings and performance improvements in next-generation electronic devices such as large-capacity non-volatile memories (MRAMs) and microwave oscillators.

The award ceremony

IP Bridge Exhibit 2032
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