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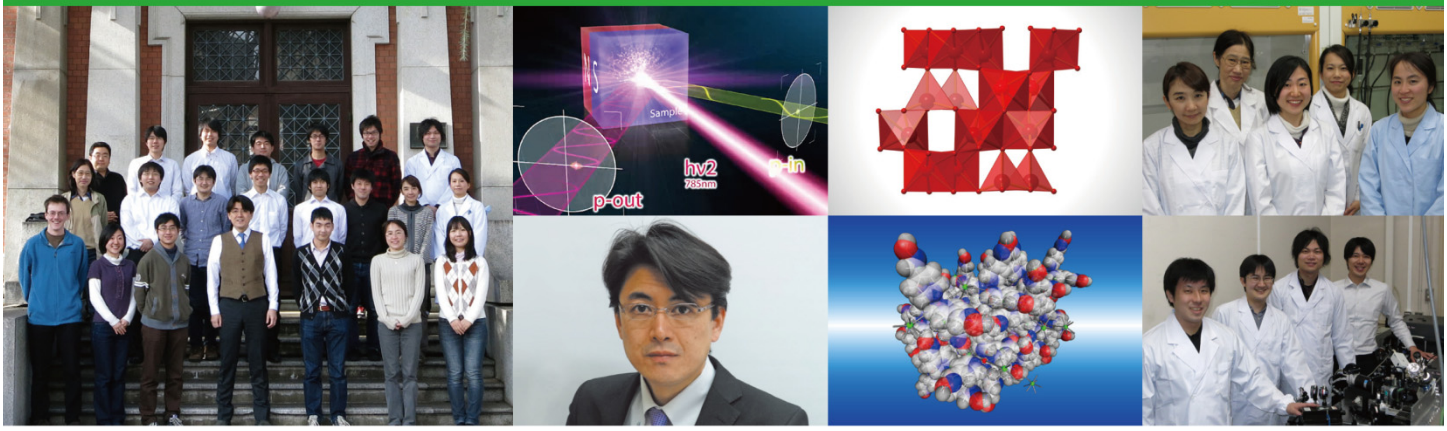

THE UNIVERSITY OF TOKYO

Making the most of magnetic materials

Magnetic recording media that possess unprecedented reliability, hybrid motors that do not depend on rare earth elements, next-generation wireless communications that ensure stable and secure transmission, and paint that can protect signals coming from a sensitive surgical device from interference or block unwanted phone calls in a movie theatre.

These are just some of the vast array of applications of magnetic chemistry being developed by researchers at Shin-ichi Ohkoshi's laboratory at The University of Tokyo.

Most recently, the team developed a magnet that could switch the polarization plane of light by 90 degrees. This discovery, which could be used in optical switching or optical memory for computers, resulted from an investigation into the relationship between the crystal structure of Prussian blue materials and their magnetic and optical properties. The discovery built on earlier work in which the properties of Prussian blue were used to make magnets that were sensitive to humidity and non-magnets that could be turned into magnets when they were irradiated with light.

The group has also given new life to iron oxides, which are safe and cheap but whose use in magnets has been limited because of their small coercive force. The ε-iron oxides synthesized in Ohkoshi's laboratory have, even at room temperature, a coercive field greater than any seen in ferrite magnets—useful features for manufacturers of hybrid motors and magnetic recording media.

Titanium oxide, which is often used in cosmetics and white pigments, also got a makeover. The λ-titanium oxide developed by Ohkoshi's group is the first example of a metal oxide exhibiting light-induced phase transition at room temperature. Using this λ-titanium oxide could produce much optical recording media with higher density than conventional germanium-antimony-tellurium optical discs. Moreover, because of the low pressure of its phase transition, "λ-Ti_3O_5 has the possibility as a solar heat storage material in which solar heat is stored and energy is released by pressure," says Ohkoshi.

These exciting developments have been a boon for up-and-coming researchers. Members of Ohkoshi's laboratory have received over 20 awards, including poster presentation awards at international conferences, The University of Tokyo President Prize, and the Dean of School of Science Prize. "I push my staff members or students to present at conferences," says Ohkoshi.

Ohkoshi's team now sits in a dense web of international collaborations in which it provides samples or carries out joint measurements with some 20 research groups in Europe, the USA, China, and elsewhere. Ohkoshi has worked with a UK research group through a Japan-UK exchanging program, served as an invited professor at Durham University in the UK, the University of Pierre and Marie Curie and the University of Bordeaux in France, and, most recently, Palacký University in the Czech Republic as part of a European Union project. In Tokyo, he also hosts professors, researchers, and students from universities around the world.

Efforts by The University of Tokyo's Technology Licensing Organization and the Division of University Corporate Relations to exploit the research have paid off with 115 patent applications and 46 registered patents. Unsurprisingly, the unique and powerful technology is luring in industry: Ohkoshi collaborates with more than 20 companies, and another 60 parties from within Japan and outside have expressed interest. "I strive to make a harmonious research environment that can contribute to society," he says.

Department of Chemistry

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