













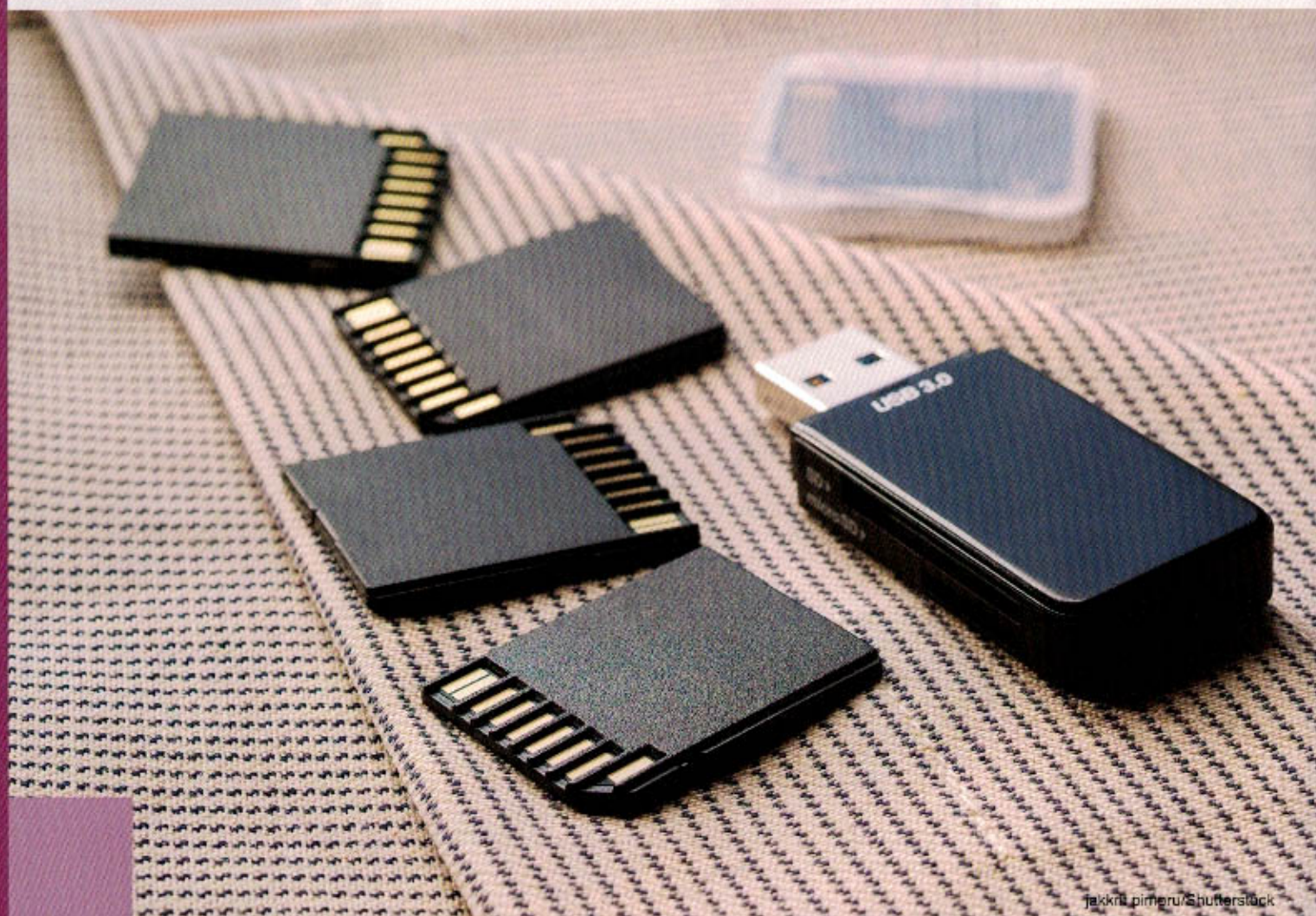
Spotlight on Research

2016-2017
Hokkaido University

	Shell-swinging snails knock out predators	1		Bonding to bones strongly	13
	A new system to detect spinal deformity	3		On the path toward molecular robots	15
	Why is the surface of ice wet?	5		The switch that could double USB memory	17
	The gene of autumn colours	7		Extraordinary cancer resistance	19
	Cold medicine could stop cancer spread	9		Who gets most distracted by cell phones?	21
	How to be a male without the Y chromosome	11		Introduction to Hokkaido University	23

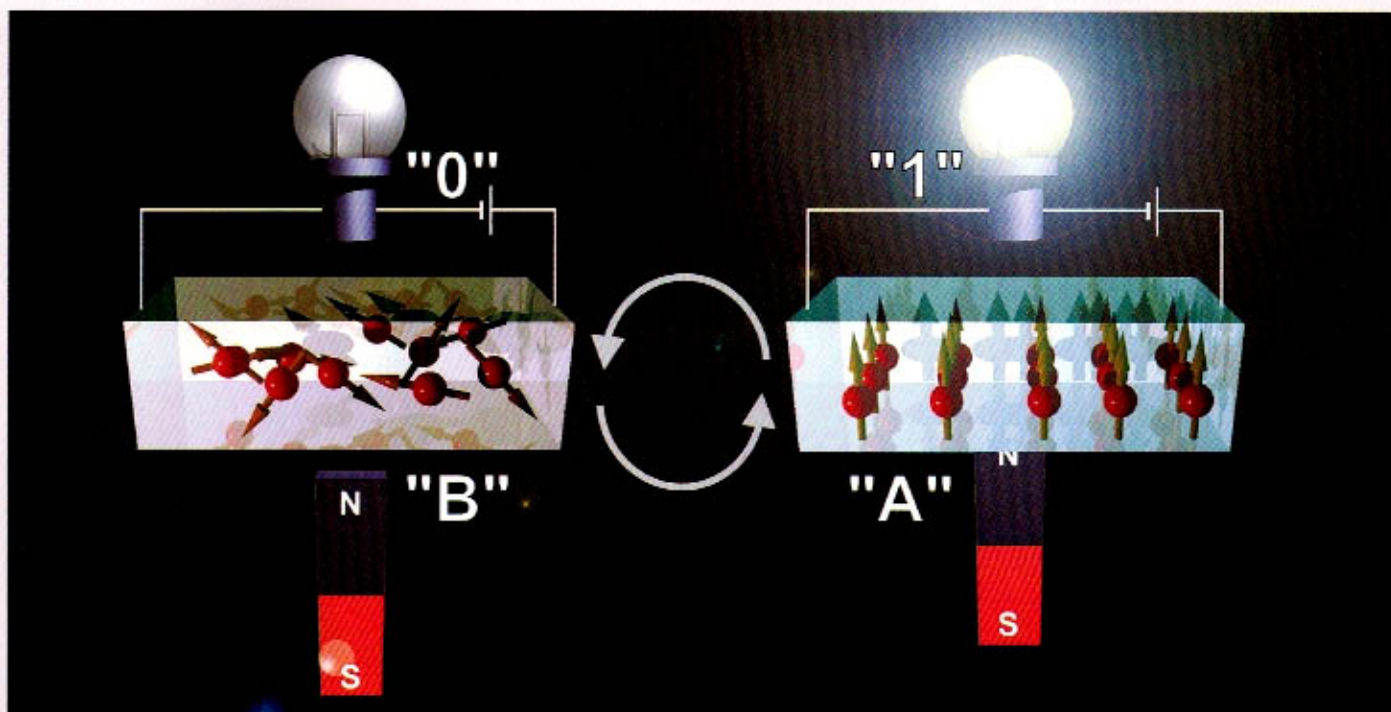


The switch that could double USB memory



jakkrit pirneru/Shutterstock

Scientists have developed a device that employs both magnetic and electronic signals, which could provide twice the storage capacity of conventional memory devices.



Using two forms of strontium cobalt oxide with different oxygen content, the device can be switched from an insulating/non-magnet state to a metallic/magnet state simultaneously by electrochemical oxidation/reduction reaction at room temperature in air.

Conventional USB flash drives are electronic data storage devices. They store information by using millions of small gates that process information into “words” consisting of various combinations of the numbers 0 and 1.

A team of scientists at Hokkaido University’s Research Institute for Electronic Science investigated the possibility of using a magnetic signal along with the electronic signal to allow double the storage capacity in these “multiplex writing/reading” devices. In addition to the binary 0/1 method of storing information, this would add an A/B store for the information as well. To do this would require finding a material that can switch back and forth from a magnet to a non-magnet state.

The team investigated two forms of strontium cobalt oxide (SrCoOx): one is an insulating non-magnet while the other is a metal magnet. By changing the oxygen content in this compound, the team could cause it to switch between the two forms.

However, the two methods currently available to do this have big drawbacks. One method requires using a high temperature heat treatment. This would make it impossible to be used in devices that work at room temperature, such as your mobile phone. The other method involves using a dangerous alkaline solution. This would require a device that is sealed so that the solution does not leak. This method is difficult to miniaturize and is thus not suitable for information storage devices.

The team developed a new method to use strontium cobalt oxide safely at room temperature. They applied a thin film of sodium tantalate, which can be used at room temperature without leaking alkaline solution, over layers of strontium cobalt oxide. When a three-volt current was applied (or about one-seventh of the voltage required in currently available USB flash drives), the insulating form of SrCoO_{2.5} reversibly switched to its metal magnet form, SrCoO₃, in three seconds. By comparison, current devices can store information in 0.01 seconds. Making the device smaller would shorten the time needed for the compound to switch between an insulator and a magnet, the researchers say. This would allow the storage of an even larger number of photos and videos in mobile phones, for example.

Researcher Details



Hiromichi Ohta

Hiromichi Ohta
Professor
Laboratory of Functional Thin Film Materials
Research Institute for Electronic Science
Hokkaido University

hiromichi.ohta@es.hokudai.ac.jp

Takayoshi Katase
Associate Professor
Laboratory of Functional Thin Film Materials
Research Institute for Electronic Science
Hokkaido University

katase@es.hokudai.ac.jp

Original paper:
Katase T, et al., Reversibly switchable
electromagnetic device with leakage-free
electrolyte, *Advanced Electronic
Materials*, Mar 29, 2016
DOI: 10.1002/aolm.201600044