Storing spin information in germanium at room temperature

Development toward a novel transistor with ultra-low power consumption

Spintronics, a new type of technology, has recently attracted much attention because of its potential to reduce the power consumption of electronic devices, which are indispensable in our present life. It has been expected that a “spin transistor” with ultra-low power consumption can be realized if the spin information of a magnetic material can be transferred to a semiconductor.

We have demonstrated the transfer of spin information from iron into p-type germanium at room temperature. Germanium is a promising candidate as the semiconductor material for next-generation MOS transistors. This achievement is an important breakthrough in the development of a spin transistor with prospective application in the so-called green information technology.

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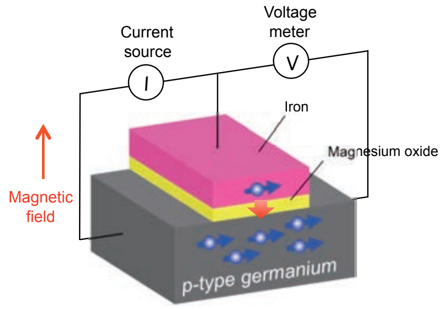
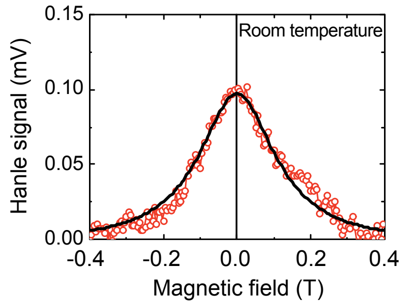


Schematic image of the device structure for observation of spin signal



Spin signal of germanium at room temperature (red circle)

Novel preparation technique enhancing oxidation activity of Pt catalysts

Formation of efficient contacts between Pt and promoter that enables CO oxidation below room temperature

The use of additives to promote catalytic reactions over platinum group metals (PGMs) is employed in various applications. To optimize interactions between PGMs and promoters, it is necessary for uniform contacts to exist between them. We have developed a preparation technique of Pt catalyst that enables CO oxidation at low temperatures. Concretely, Pt/Fe-containing alumina catalysts were prepared and treated with water under moderate conditions. From structural analyses of the catalysts, it was concluded that Pt nanoparticles and iron oxides formed efficient contacts in the catalysts probably because of the enhanced mobility of Pt species. Surprisingly, these catalysts could catalyze CO oxidation at low temperatures—even below 0 ℃ . The concept of interface fabrication demonstrated in this example provides an opportunity to significantly reduce the use of PGMs in catalysts.

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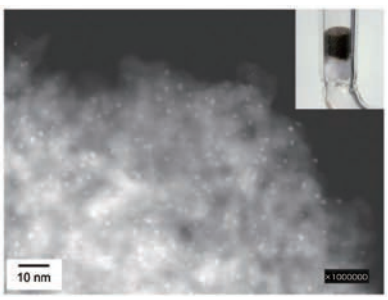
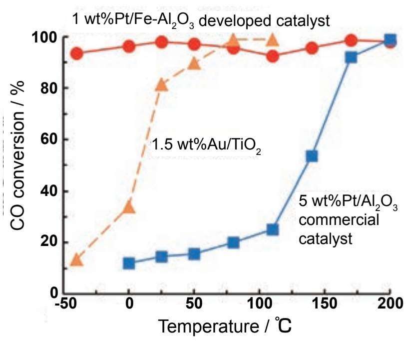


HAADF-STEM image and optical photograph of the developed catalyst
Pt particles having diameters of ≈ 1.5 nm are highly dispersed on the support.



Temperature dependence of CO conversions over the catalysts in (1 % CO + 0.5 % O_2)/N_2