New technology for ultra-low power magnetic information writing
First demonstration of radio-frequency-voltage-assisted magnetization switching

We have developed a new technology to reduce the energy for magnetic information writing using the radio-frequency-voltage-induced ferromagnetic resonance (FMR). Magnetization reversal assisted by resonance dynamics is an important technique for future magnetic information technology, such as in the next-generation hard disc drive. However, we usually need an application of high-electric current to induce the large magnetization precession, which results in unwanted energy loss due to Ohmic dissipation. In this study, we employed the voltage control of magnetic anisotropy in an ultrathin ferromagnet to excite the FMR dynamics, and observed clear reduction in the magnetization reversal field, as large as 80 %, without the electric-current application.

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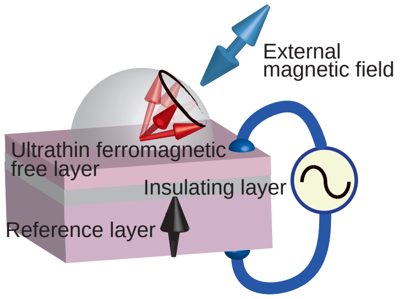
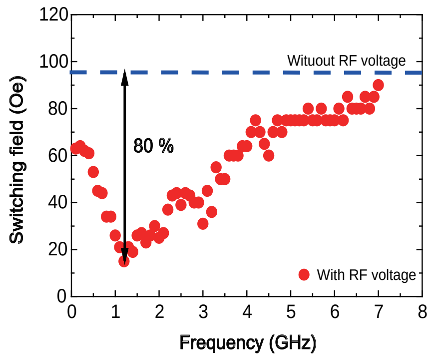


Schematic of the magnetic tunnel junction used in this study
Radio-frequency voltage application induces ferromagnetic resonance dynamics in the magnetization of an ultrathin ferromagnetic free layer (red arrow) and causes reduction in the magnetization switching field.



Radio-frequency (RF) voltage-assisted magnetization reversal
Reduction rate of more than 80 % was achieved at around 1GHz.

A novel switchable mirror with visible transmittance of over 70 % in the transparent state
Annual cooling and heating load in buildings can be reduced using this mirror as window panes.

With switchable mirrors, their optical properties can be changed reversibly between reflective and transparent states. Therefore, the mirrors in the reflective state can reduce cooling load in office buildings by blocking the solar radiation entering the rooms through windows. However, if the transmittance in the transparent state is not high enough, the heating load increases more than the decrease in cooling load, and consequently the annual load increases. We have improved the optical properties of switchable mirrors using antireflection coating and have achieved switchable mirrors with visible transmittance of over 70 % with neutral color appearance in the transparent state. The mirror also has large dynamic range of over 60 % between reflective and transparent states. Thus, it is expected that the newly developed switchable mirror can reduce annual cooling and heating loads in buildings. From now, we will estimate its weatherproof performance against solar radiation.

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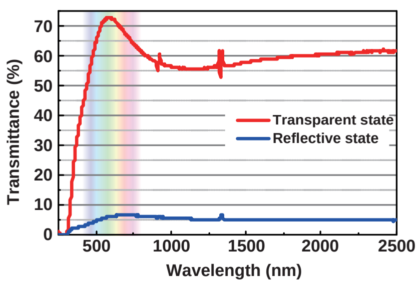

Transmittance spectra of a newly developed switchable mirror in the reflective and transparent states

A newly developed switchable mirror coated with antireflection layer
Upper: the reflective state, Lower: the transparent state