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著者(和文)	白幡泰浩
Author(English)	Yasuhiro Shirahata
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A new concept for controlling magnetization orientation in ferromagnet/ferroelectric heterostructures is indispensable for future spintronics to be operated at a low energy consumption level, compared with the conventional controlling technologies of magnetization orientation. With this view, issues of how to control magnetization orientation using magnetoelectric effects at the interface are of crucial importance. Despite great efforts so far, the issue has been still elusive. On the other hand, the detection of electron spin is also very important to pave a new pathway to developing spintronic devices. A number of studies of electron spin transmission across ferromagnet/semiconductor interface have been done for a robust approach to detecting electron spin, although it has not been established yet. This work sheds some light on these two issues by focusing the research on perpendicularly magnetized multilayers to control the magnetization orientation by external means as well as to detect electron spin in semiconductor at remanence. Magnetic anisotropy of magnetic metal and multilayers on ferroelectric BaTiO₃ was investigated through electrical and thermal means. Clear switching behavior of magnetic anisotropy symmetry of Fe epitaxial layers has been found as BaTiO₃ underwent the phase transition from the tetragonal to orthorhombic structural phase transition. Also, electric field driven magnetization switching and even magnetization reversal have been demonstrated in perpendicularly magnetized multilayer/BaTiO₃ heterostructures via magnetoelastic coupling effect. These results clearly show that perpendicularly magnetized multilayers/ferroelectric heterostructures are promising for electric field control of magnetic anisotropy. Spin filtering effect across magnetic metal and multilayer/GaAs interfaces was also studied using optical spin orientation method. The spin dependent photocurrent showed that the flatness of the interface is one of the most critical factors to maintain the spin polarization of magnetic metals. Furthermore, spin dependent photocurrent exhibited a marked feature at a forward bias voltage for perpendicularly magnetized multilayer/GaAs interfaces, while the circular polarization dependent photocurrent showed a hysteretic behavior. The results revealed that perpendicularly magnetized multilayers have a great potential to be used as a spin detector in future spintronic devices. From these results, this research shows epitaxially engineered structures composed of ferromagnets, ferroelectrics and semiconductors provide a promising basis for designing spintronic devices in the future.