Electron spin resonance of magnesium oxide thin films grown on silicon

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To realize silicon(Si)-based-spintronics devices, the spin injection into Si from ferromagnetic materials is essential. Since a high-spin polarization (>99%) has been demonstrated using MgO(001)|Fe(001) [1], a spin device with a Si|MgO|Fe structure attracts much attentions [2]. However, the spin-polarization of injected carriers in Si is still low (7.5%)[3]; hence, we evaluated MgO-thin films grown on Si by means of an electron spin resonance (ESR) technique. The ESR is a powerful tool to investigate the quality of a grown-thin films. In this study, the MgO films were grown on a Si substrate using molecular beam epitaxy (MBE) methods (<10^{-7} Pa) after removing an oxidized layer on the Si surface using hydrofluoric acid. After the grown of the MgO films, we performed cavity ESR measurements at 10 K. Figure 1(a) shows the two ESR spectra from the MgO film (black) and MgO source (red). The ESR spectrum of MgO film is different with that of the MgO source. Figure 1(b) shows the ESR intensity of the MgO films as a function of the thickness of the MgO films. Noted that the intensity is defined as the integrated area in the peaks. Since the intensity increases as the thickness of the MgO increases, and hence such ESR spectrum comes from the bulk components in the MgO films. This work was supported by TDK and Osaka University INTERACTIVE MATERIALS SCIENCE CADET .

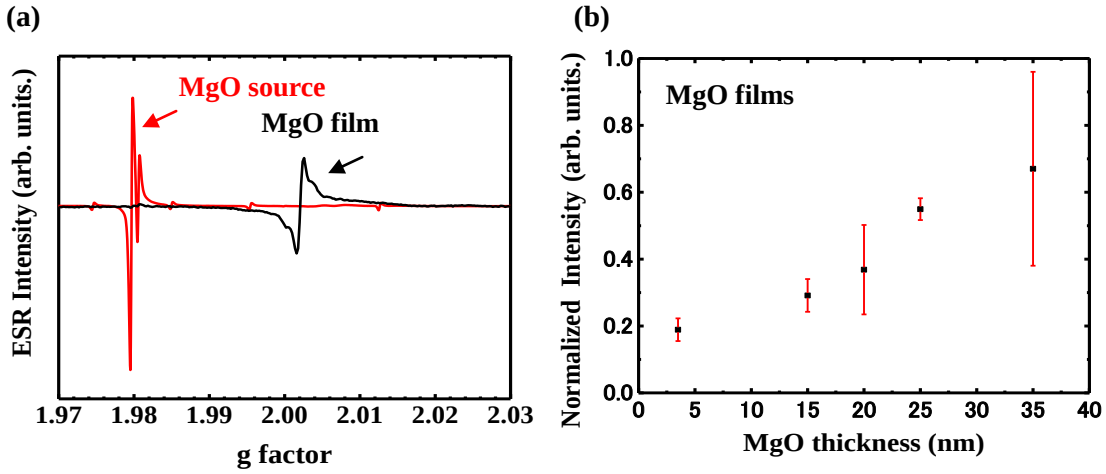

FIG .1 (a) ESR signals of MgO source (red) and MgO deposited film(35nm) (black)
(b) MgO thickness dependence of ESR intensity

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[3] T. Sasaki et al., Appl. Phys. Lett. **104**, 052404 (2014).