反強磁性体 NiO 薄膜の磁区構造の結晶方位依存性

Magnetic domain structure of antiferromagnetic NiO thin films with different crystal orientations

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Antiferromagnetic thin films have potential to be used for future robust and high-density magnetic memory devices because of the small magnetic susceptibility. One of the issues towards the development of the antiferromagnetic memory device is that it is difficult to detect and manipulate antiferromagnetic domains. Recently, it has been reported that magnetic domain imaging in antiferromagnetic NiO thin films by using a table-top polarization microscopy [1], which is more convenient experimental technique for magnetic domain manipulation in antiferromagnetic thin films, comparing with a technique using a high energy light source such as the X-ray magnetic linear dichroism. In this work, we report imaging of antiferromagnetic domain structure of NiO thin films with different crystal orientations using a table-top polarization microscopy.

40-nm-thick NiO thin films were deposited, by using magnetron sputtering method, on a single crystalline MgO substrate with different crystal orientations. The magneto-optical birefringence effect was used to detect the antiferromagnetic domain structure in the NiO. Figure 1(a) shows a schematic illustration of the optical setup for detecting the antiferromagnetic domain structure of the NiO thin films. We used a light-emitting diode (LED) with wavelength of 625 nm as a light source. The light through a linear polarizer was illuminated on the sample. Then, the sample surface was imaged through a half-wave plate (HWP) and an analyzer. The Kerr rotation angle at each pixel of the image was evaluated by rotating HWP. Figure 1(b) shows the Kerr rotation angle distribution of a NiO (100) thin film grown on MgO (100), which corresponds to a magnetic domain structure. We observed that the Kerr rotation angle distribution varies depending on crystal orientations of the NiO thin film, which will be discussed in the presentation.

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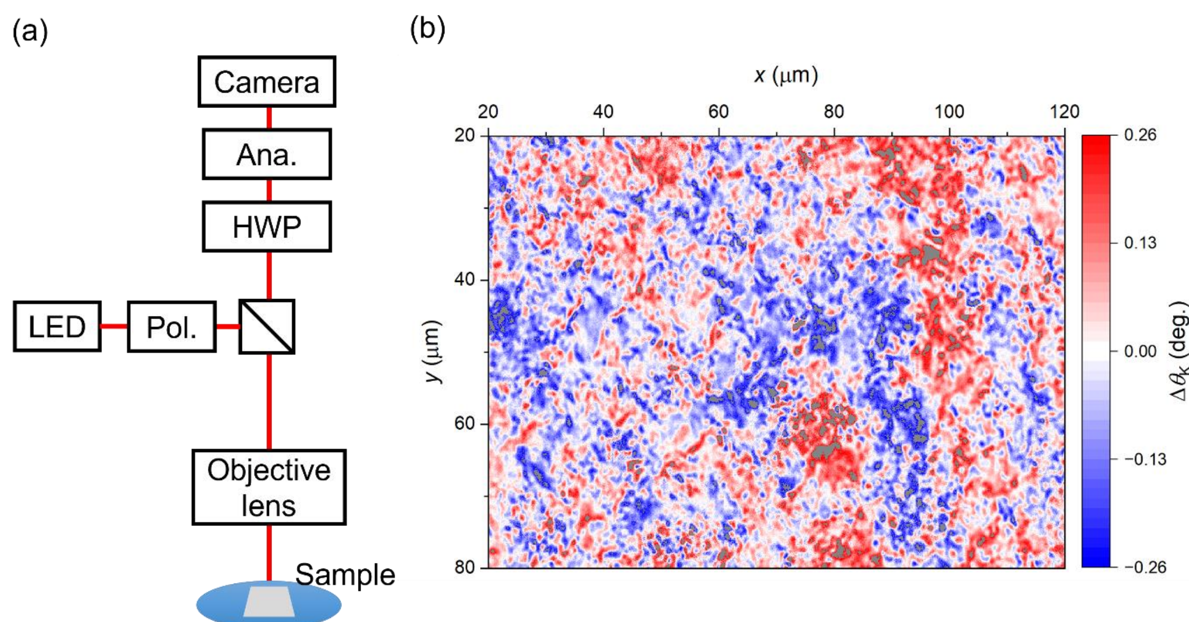

Figure 1 (a) A table-top optical setup for measuring a magnetic domain structure. (b) The Kerr rotation angle distribution for the 40-nm-thick NiO thin film grown on a MgO(100) substrate.