



Crystallographic orientation of rare-earth permanent magnet

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1. 背景と研究目的

As the wave of electrification accelerates toward carbon neutrality, the demand for high-performance permanent magnets—essential components for successful electrification—continues to grow^[1]. In particular, the development of anisotropic permanent magnets is crucial to maximize magnetic performance. In anisotropic magnets, the remanence is enhanced when the grains are well aligned with the external magnetic field direction. Therefore, the crystallographic alignment plays a decisive role in determining the performance of anisotropic permanent magnets, making its precise evaluation essential for magnet development. In this study, the crystallographic alignment of anisotropic SmCo₅ magnets was analyzed using X-ray diffraction (XRD) pole figure measurements.

2. 実験内容

An SmCo₅ ingot was prepared by induction melting and subsequently pulverized by ball milling to obtain SmCo₅ powders. The powders were magnetically aligned under a 2 T magnetic field using an electromagnet and then pressed to form a green compact. The compact was sintered at 600 °C under 100 MPa, resulting in an anisotropic magnet. X-ray diffraction (XRD) measurements were conducted at the BL8S1 beamline of the Aichi Synchrotron Radiation Center, using an X-ray energy of 14.37 keV. The measured plane was perpendicular to the magnetic alignment direction. The XRD pole figure was measured for the (001) peak of SmCo₅ over the range of $\alpha = 0\text{--}50^\circ$ and $\beta = 0\text{--}360^\circ$.

3. 結果および考察

The easy magnetization direction of SmCo₅ lies along the *c*-axis^[2]. When a pole figure is measured at the (001) peak, a pattern with strong intensity concentrated at the center is typically observed. Fig. 1 shows the pole figure of the anisotropic SmCo₅ magnet. The concentration of intensity at the center indicates that the SmCo₅ grains are crystallographically aligned. However, the slightly broadened distribution of intensity is likely due to the small sample size, which can cause shape effects, or to a slight tilt of the measurement surface introduced during sample preparation.

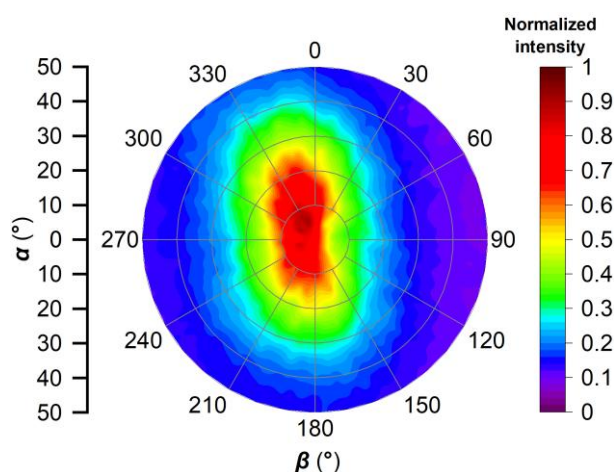


Fig. 1. XRD pole figure of the SmCo₅ magnet.

4. 参考文献

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