表題：単結晶中性子回折による $NdCo_2Zn_{20}$ の磁気構造の研究

Single-crystal neutron diffraction study of the magnetic structure of $NdCo_2Zn_{20}$

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Rare-earth-based RTr_2X_{20} (*Tr*: transition metal, X = Al, Zn and Cd) are a family of caged compounds that have been extensively studied. They crystallize in the cubic $CeCr_2Al_{20}$-type structure (T. Nasch, W. Jeitschko, and U. C. Rodewald, Z. Naturforschung **52B**, 1023 (1997).). In the present experiments, we focused on $NdCo_2Zn_{20}$ with the magnetic Γ_6 doublet ground state of $4f^3$ configuration. The magnetic specific heat C_m exhibit a sharp peak at T_N = 0.53 K. The peak at T_N is shifted to lower temperatures with increasing magnetic fields, which is a characteristic of the AFM order. On the other hand, the electrical resistivity $\rho(T)$ shows downward curvature in the moderately wide temperature range of $T_N < T < 4$ K. Taking the reduced magnetic entropy S_m of $(0.5)R\ln 2$ at T_N into consideration, the anomalous $\rho(T)$ behaviour results from enhanced *c*-*f* hybridization and/or magnetic frustration in the Γ_6 doublet ground states of the Nd^{3+} ions (R. Yamamoto *et al.*, JPSJ **88**, 044703 (2019).).

In this work, single-crystal neutron diffraction measurements were performed to determine the magnetic structure of $NdCo_2Zn_{20}$. We carried out the neutron diffraction experiments using the triple-axis spectrometer T1-1 (HQR). The sample with the weight of 193.7 mg glued onto the Cu plate was cooled down to 0.3 K using a 3He refrigerator. The incident neutron wavelength was 2.46 $Å^{-1}$. As shown in Fig. 1, the magnetic reflection was observed at $\boldsymbol{Q}$ = (1/2, 1/2, 1/2) and its equivalent $\boldsymbol{Q}$ positions at the lowest temperature of 0.3 K. The reflections are associated with the propagation vector $\boldsymbol{k}$ = [1/2, 1/2, 1/2]. This result is consistent with s super-lattice peak measured by the powder neutron diffraction with a two-axis diffractometer G4-1 at the Orphée reactor of Laboratoire Léon Brillouin, France. In the present measurements, more than 10 magnetic reflections were observed, whereas one magnetic reflection was detected in the previous powder neutron diffraction measurements. The peak intensity at $\boldsymbol{Q}$ = (1/2, 1/2, 1/2) steeply increases on cooling below T_N. This behavior suggests the first-order nature of the transition. Detailed analysis of the magnetic structure with the single crystal neutron diffraction data is now in progress.

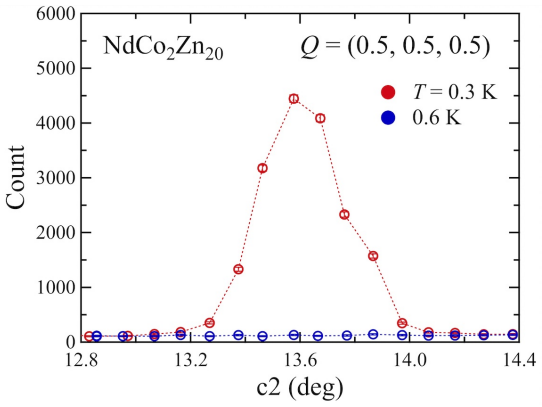

Fig. 1. Profile scan at around $\boldsymbol{Q}$ = (1/2, 1/2, 1/2) below and above T_N as T = 0.3 and 0.6 K, respectively. The magnetic reflection was observed at 0.3 K and it disappears at 0.6 K.

使用施設：JRR-3M, 装置：T1-1:HQR

分野：Strongly Correlated Electron Systems