# Detection of the anti-symmetry in the single crystals of CeRhSn by uniaxial annealing

Yasuyuki Shimura[A], Daichi Kurumi[A], Kanta Watanabe[A], Takanori Taniguchi[B], and Takahiro Onimaru[A]

AdSE, Hiroshima Univ. [A], IMR, Tohoku Univ. [B]

CeRhSn is a hexagonal compound in which Ce forms a pseudo-Kagome lattice, and does not show magnetic order. Measurements of the thermal expansion coefficient down to 0.05 K showed that the thermal expansion coefficient in the in-plane direction of the pseudo-Kagome lattice increases divergently toward lower temperatures. On the other hand, the thermal expansion coefficient in the direction perpendicular to the pseudo-Kagome plane (perpendicular to the plane) shows almost no change with temperature [1]. From this result, it was found that CeRhSn is in an "anisotropic" quantum critical state that is sensitive to in-plane uniaxial pressure/uniaxial strain, rather than the isotropic hydrostatic pressure commonly observed. In this case, it is expected that the magnetic order will appear beyond the quantum critical point if a slight uniaxial strain is applied in the in-plane direction.

In this study, we use neutron scattering to clarify whether a sample of a single crystal of CeRhSn that has been subjected to axial annealing is distorted. The axial annealing method is a technique in which a single crystal sample is heated to a temperature just before melting point while applying uniaxial pressure in a vacuum, and then rapidly cooled to hold distortion in the sample.

Single-crystal neutron diffraction experiments were performed on three CeRhSn single crystals (unprocessed, annealed without axial pressure, and axially annealed) under different conditions. Peaks were observed at 2θ ~ 60°, which corresponds to the interplanar spacing of the (002) plane. The diffraction angle 2θ was fixed, and the dependence of the sample rotation angle ω was examined. It was found that the crystalline was deteriorated by quenching, and that the sample was plastically deformed by the annealing under uniaxial stress. The lattice constant was calculated from the 2θ dependence of the diffraction intensity, and the c-axis length of the axially annealed sample was 0.3% smaller than that of the unprocessed sample. However, since the sample annealed and quenched at atmospheric pressure showed a similar degree of shrinkage, it is likely that this is not the effect of uniaxial stress, but simply due to strain caused by quenching. Furthermore, a comparison of the full width at half maximum of the peaks obtained from the 2θ dependence showed clear differences among the three samples, with the axially annealed sample showing the largest increase in full width at half maximum, indicating that this technique resulted in the formation of domains that elastic strain is retained.

[1] Y. Tokiwa, C. Stingl, M.S. Kim, T. Takabatake and P. Gegenwart., Sci. Adv. **1**, e1500001 (2015).

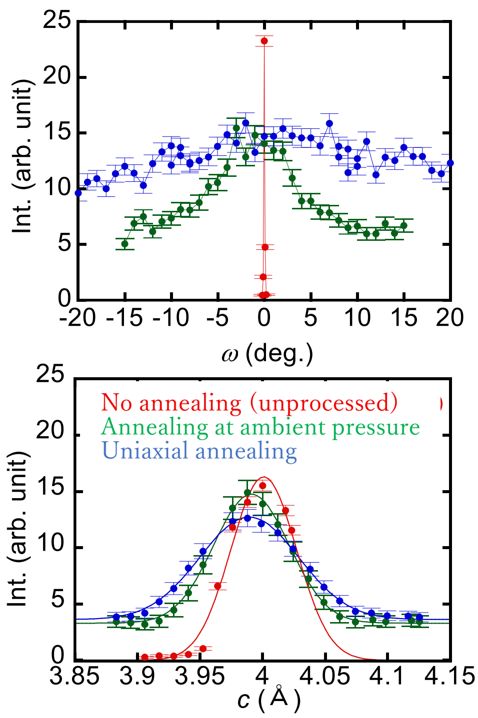


Fig. 1: Dependence of peak intensity on sample rotation angle ω (top) and lattice constant (bottom) for each sample.