X-ray Modulation Structural Study of $RENiC_2$ under High Magnetic Field

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$RENiC_2$, low-dimensional rate-earth(RE) compounds, crystallize in the non-centrosymmetric orthorhombic $CeNiC_2$ type structure with a space group Amm2. H. Onodera and his co-workers have reported their interesting magnetic features dependent on the atomic species of RE. Among them, only $SmNiC_2$ shows a first-order ferromagnetic transition at T_C=17.5 K [1]. The magnetization has demonstrated that metamagnetic transition occurs from paramagnetic to ferromagnetic under field along the magnetically easy ***a*** axis with a small hysteresis. In other words, T_C increases almost linearly with the magnetic field [1]. With cooling, the electrical resistivity shows a small increase at T_1 of 150 K but a sudden decrease at T_C. This behavior in the electrical resistivity can be interpreted in terms of the generation and disappearance of charge density wave (CDW), since incommensurate satellite reflections appear at T_1 but disappear at T_C[2].

Interested in structural response of $RENiC_2$, we developed highly sensitive X-ray camera under magnetic field up to 10T. This unique monochromatic "Laue camera" under field enables to observe large area in the reciprocal lattice space in one photograph. This X-ray camera will be very effective to detect incommensurate and unexpected modulations under field. We applied a magnetic field to a single crystal of $SmNiC_2$ along the ***a***-axis and took X-ray photos to observe possible field effect for the incommensurate modulation structure. Although the field dependence of the satellite intensity in the paramagnetic region was small, but sudden disappearance was observed in the metallic ferromagnetic region. Furthermore, its phase boundary between modulated and uniform phases is consistent with the boundary between resistive paramagnetic and metallic ferromagnetic phases. In short, this study shows the uniform ferromagnetic metallic phase is induced by field.

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