

(29b1)

## Nuclear resonant scattering study on the local electronic state and lattice dynamics of filled Skutterudite compounds

S. Tsutsui<sup>1</sup>, Y. Kazekami<sup>2</sup>, J. Umemura<sup>2</sup>, M. Sakata<sup>3</sup>, H. Kobayashi<sup>2</sup>, H. Onodera<sup>3</sup>, C. Sekine<sup>4</sup>, I. Shirotnani<sup>4</sup> and Y. Yoda<sup>1</sup>

<sup>1</sup>Japan Synchrotron Radiation Research Institute, SPring-8, Mikazuki, Hyogo 679-5198

<sup>2</sup>Graduate School of Materials Science, University of Hyogo, Kamigori, Hyogo 678-1297

<sup>3</sup>Graduate School of Science, Tohoku University, Sendai, Miyagi 980-8577

<sup>4</sup>Department of Electrical and Electronic Engineering, Muroran Institute of Technology, Muroran, Hokkaido 050-8585

Nuclear resonant scattering (NRS) is a Mössbauer spectroscopy using synchrotron radiation. NRS spectra provide not only local electronic states at probe nuclei but also local phonon density of states at probe atoms. The former ones are obtained by nuclear resonant forward scattering (NRFS), whereas the latter by inelastic nuclear resonant scattering (INRS). SmRu<sub>4</sub>P<sub>12</sub> shows a metal-insulator (MI) transition at  $T_{\text{MI}} = 15$  K. The entropy at  $T_{\text{MI}}$  reaches  $R \ln 4$ . This suggests that an MI transition as well as a quadrupole ordering also occurs at  $T_{\text{MI}}$ . [?] We have performed <sup>149</sup>Sm NRFS and INRS of SmRu<sub>4</sub>P<sub>12</sub>. Both measurements were carried out at BL09XU of SPring-8. The energy of x-ray is a <sup>149</sup>Sm Mössbauer resonance of 22.494 keV. A set of Si(4 4 0), Si(16 8 8) and Ge(4 4 2) is used as a high resolution monochromator, whose resolution is 1.5 meV. The sample measured is a powdered polycrystalline one. Integrated signal of NRFS drops by one order at  $T_{\text{MI}}$  as temperature decreases. Quantum beats are observed only below  $T_{\text{MI}}$ . On the other hand, no changes in INRS are observed across  $T_{\text{MI}}$ . These results indicate that the local electronic state changes across  $T_{\text{MI}}$  at Sm atoms and the density of the local phonon states does not.

## References

- [1] K. Matsuhira *et al.*, J. Phys. Soc. Jpn., **71** Suppl.(2002) 237.