

强相关电子物性研究室

欢迎访问室兰工业大学 关根研究室



室兰工业大学
情报电子工学学院

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研究简介

主要 采用高温高压设备制备的功能材料并研究其物理性能（以热电转换材料， 超导体材料为主

所属专业

博士专业

先端情报电子工学课程

硕士专业

强相关电子物性研究室 研究室成员

2016-2017年度 研究室成员	
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助教	川村 幸裕 (F栋205室) 个人主页 (<i>RD_Soran</i>)
博士研究员	陈 玉奇 (平井研究室)
博士研究生	金泽 昌俊
	<i>Yuttana Mona</i>
	<i>Jirattagan Sirimart</i>
硕士研究生	池守 庆亮
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	中村 祐挥
	西根 康平
	中岛 良介
	森 英将
学士生	大泽 侑司
	星野 爱
	小田 雄斗
	长内 俊英
	早崎 友一郎
	上田 和生
	西村 和也

研究内容及设备

■ 研究概要

主要研究电子相关的新机能性材料。研究重点是以『方钴矿结构化合物』为中心的热电转换材料，超导电材料 及其在极低温，高压，强磁场等多重极限状态下的物性，电子行为等。

■ 研究室设备

高压合成设备 **UHP-1500**

UHP-500 (~4GPa)

真空手套操作箱 **Glove Box**

原位**X**线衍射仪 (@KEK) (合成过程的原位场观察)

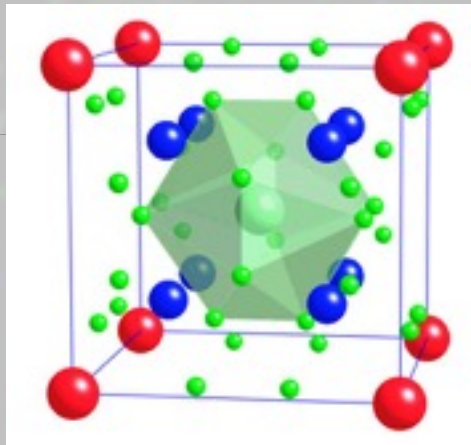
微区**X**线谱分析仪**EPMA**，扫描电子显微镜**SEM/EDS**

磁学测量系统**MPMS**

综合物性测量系统**PPMS** (可测量热电相关性能，比热等基本物性)

■ 关于方钴矿

方钴矿是一类钴和砷的矿物。因最早在挪威的一个小县城Skutterd被发现而得名。方钴矿的化合物通常被表示为 MX_3 (或者 $\text{R}_m\text{M}_4\text{X}_{12}$)，其中M为过渡族金属元素Co, Rh, Ir等，X为磷族元素P, As, Sb等。R为充填元素如稀土元素，碱金属元素等。具有充填方钴矿结构的化合物是一种高效率的热电转换材料。理想的热电转换材料具有晶体一样的导电性，同时又能够如同玻璃一样绝热。此外，某些常压下难以合成的充填方钴矿通过高压能够实现高纯度合成。而这些合成的充填方钴矿往往展现出超导等特殊物理特性。



方钴矿的晶体结构

研究成果

--成功合成并初次报导SmRu₄P₁₂---

" Low-temperature properties of new filled skutterudite SmR₄P₁₂ prepared at high pressure"

C. Sekine, T. Uchiumi, I. Shirotnani and T. Yagi, Science and Technology of High Pressure, ed. M. H. Manghnani, W. J. Nellis and M. F. Nicol, pp 826-829, Universities Press, Hyderabad, india, 2000.

2016

1. " The structural, transport, and magnetic properties of Yb-filled skutterudites Yb_yFe_xCo_{4-x}Sb₁₂ synthesized under high pressure "
Y. Chen, Y. Kawamura, J. Hayashi, K. Takeda, and C. Sekinea ,
J. Appl. Phys. **120** (2016) 235105 (9 pages)
2. " Structural Analysis of Novel Antiferromagnetic Material CeRu₂Al₁₀ "
Y. Kawamura, J. Hayashi, K. Takeda, C. Sekine, H. Tanida, M. Sera, T. Nishioka ,
J. Phys. Soc. Jpn., **85** (2016) 044601(7 pages)
3. " 75As-NQR study of the hybridization gap semiconductor CeOs₄As₁₂ "
M. Yogi, N. Higa, H. Niki, T. Kawata, C. Sekine ,
J. Phys.: Conf. Series, **683** (2016) 012030 (5 pages)
4. " Enhanced thermoelectric performance of optimized Yb-filled and Fe-substituted skutterudite compounds Yb_{0.6}Fe_xCo_{4-x}Sb₁₂ "
Y. Chen, Y. Kawamura, J. Hayashi, C. Sekine ,
Jpn. J. Appl. Phys., **55** (2016) 04EJ02 (5 pages)

2015

1. " Magnetic Properties of New Filled Skutterudite Compound BaFe₄As₁₂ "
C. Sekine, T. Ishizaka, K. Nishine, Y. Kawamura, J. Hayashi, K. Takeda, H. Gotou, Z. Hiroi,
J. Phys.: Conf. Series Physics Procedia, **75** (2015) (383 ~ 389)
2. " Nd-ion Substitution Effect on f-electron Multipole Order of PrRu₄P₁₂ "
K. Iwasa, A. Yonemoto, S. Takagi, S. Itoh, T. Yokoo, S. Ibuka, C. Sekine, H. Sugawara
Physics Procedia, **75** (2015) (179 ~ 186)
3. " Pressure Dependence of Superconductivity in Filled-Skutterudite YOs₄P₁₂ "
Y. Kawamura, H. Mikage, Y. Chen, J. Hayashi, C. Sekine, H. Gotou, Z. Hiroi ,
Physics Procedia, **75** (2015) (200 ~ 205)

4. "Thermoelectric properties of $\text{YbxCo}_4\text{Sb}_{12}$ prepared under high pressure"
Y. Chen, Y. Kawamura, J. Hayashi, C. Sekine,
Jpn. J. Appl. Phys., **54** (2015) (055501)(5 pages)
5. "Investigation of ferromagnetic filled skutterudite compound $\text{EuFe}_4\text{As}_{12}$ "
C. Sekine, K. Ito, K. Akahira, Y. Kawamura, Y. Q. Chen, H. Gotou, K. Matsuhira,
J. Phys.: Conf. Series, **592** (2015) (012032)(6 pages)
6. "Magnetic Properties of Filled Skutterudite $\text{EuFe}_4\text{As}_{12}$ under Pressure"
Y. Kawamura, Y. Q. Chen, T. Nakayama, R. Shirakawa, J. Hayashi, K. Takeda, C. Sekine,
J. Phys.: Conf. Series, **592** (2015) (012033)(6 pages)

2014

1. "In-situ observation of $\text{Mm}_x\text{Co}_4\text{Sb}_{12}$ under high temperatures and high pressures "
C. Sekine, H. Kato, M. Kanazawa, Y. Kawamura, K. Takeda, M. Matsuda, K. Kihou, C.-H. Lee and
H. Gotou,
J. Phys.: Conf. Series **502** (2014) 012017 (4 pages).
 2. "NMR study of filled skutterudite $\text{Pr}_{0.9}\text{Ce}_{0.1}\text{Ru}_4\text{P}_{12}$ "
M. Yamamoto, K. Magishi, A. Hisada, T. Saito, K. Koyama, M. Takusari, H. Kato, C. Sekine
JPS Conf. Proc. **3** (2014) 011003 (6 pages).
 3. "Pressure effects on reentrant metal-nonmetal transition of $(\text{Pr}_{1-x}\text{Ce}_x)\text{Ru}_4\text{P}_{12}$ "
C. Sekine, M. Takusari, Y. Kawamura, J. Hayashi, K. Takeda, M. Matsuda, H. Gotou and T. Yagi
JPS Conf. Proc. **3** (2014) 011013 (6 pages).
 4. "Synchrotron X-ray diffraction study of $\text{CeRu}_2\text{Al}_{10}$ under high pressure and low temperature "
Y. Kawamura, T. Kawaai, T. Nakayama, J. Hayashi, K. Takeda, C. Sekine, T. Nishioka, Y. Ohishi
JPS Conf. Proc. **3** (2014) 011029 (5 pages).
-
5. " ^{75}As -NQR study of the Kondo semiconductor $\text{CeFe}_4\text{As}_{12}$ "
M. Yogi, H. Niki, T. Kawata and C. Sekine
JPS Conf. Proc. **3** (2014) 011046 (6 pages).
 6. "Fe substitution effect on filled skutterudite superconductor $\text{LaRu}_4\text{P}_{12}$ "
T. Kawaai, Y. Kawamura, J. Hayashi, M. Matsuda, H. Nakane, H. Gotou and C. Sekine
JPS Conf. Proc. **3** (2014) 011084 (5 pages).
 7. "X-ray study with synchrotron radiation for new filled skutterudite $\text{GdFe}_4\text{As}_{12}$ at ambient
pressure and high pressures "
K. Takeda, Y. Kawamura, K. Ito, J. Hayashi, K. Matsui, H. Nakane and C. Sekine
JPS Conf. Proc. **3** (2014) 017019 (6 pages).

8. " Absence of time-reversal symmetry breaking in the noncentrosymmetric superconductor $\text{Mo}_3\text{Al}_2\text{C}$ "
E. Bauer, C. Sekine, U. Sai, P. Rogl, P. K. Biswas and A. Amato
Phys. Rev. B **90** (2014) 054522 (5 pages).

2013

1. " Thermoelectric properties of Kondo semiconductor $\text{CeRu}_4\text{As}_{12}$ prepared under high pressure "
C. Sekine, T. Kawata, Y. Kawamura and T. Yagi
J. Korean Phys. Soc. **63** (2013) 359-362.
2. " Ultrasound measurements on the skutterudite compound $\text{SmOs}_4\text{P}_{12}$ "
Y. Nakanishi, G. Koseki, D. Tamura, K. Kurita, T. Saito, M. Koseki, M. Nakamura, M. Yoshizawa,
Y. Koyota, C. Sekine, T. Yagi
J. Korean Phys. Soc. **62** (2013) 1855-1857.
3. " Pressure dependence of the superconducting transition temperature of the filled skutterudite $\text{YFe}_4\text{P}_{12}$ "
J.-G. Cheng, J.-S. Zhou, K. Matsubayashi, P. P. Kong, Y. Kubo, Y. Kawamura, C. Sekine, C. Q. Jin,
J. B. Goodenough, and Y. Uwatoko
Phys. Rev. B **88** (2013) 024514 (8 pages).
4. " Pressure effect on the structure and superconducting transition temperature of filled skutterudites $\text{LaT}_4\text{P}_{12}$ ($T=\text{Fe, Ru}$) "
Y. Kawamura, T. Kawaai, J. Hayashi, C. Sekine, H. Goto, J. Cheng, K. Matsubayashi and Y.
Uwatoko
J. Phys. Soc. Jpn. **82** (2013) 114702 (4 pages).

2012

1. " Magnetic and electrical properties of filled skutterudite compound $(\text{Sm}_{1-x}\text{R}_x)\text{Ru}_4\text{P}_{12}$ ($R=\text{La, Y}$) "
C. Sekine, Y. Kiyota, Y. Kawamura and T. Yagi
J. Phys.: Conf. Series **391** (2012) 012061 (4 pages).
2. " ^{149}Sm and ^{57}Fe nuclear resonant inelastic scattering of filled skutterudites $\text{SmFe}_4\text{X}_{12}$ (X : Pnictogen) "
S. Tsutsui, H. Kobayashi, Y. Yoda, H. Sugawara, C. Sekine, T. Namiki, I. Shirotnani and H. Sato,
Hyperfine Interactions **206** (2012) 67-70.
3. " Magnetic and transport properties of filled skutterudite $\text{SmOs}_4\text{P}_{12}$ under pressure "
Y. Kawamura, Y. Kiyota, C. Sekine, M. Wakeshima, K. Matsuhira,
J. Phys. Soc. Jpn. **81** (2012) SB047 (4 pages).
4. " Structural instability of unfilled skutterudite Compounds MX_3 ($M = \text{Co, Rh, and Ir}$; $X = \text{As and Sb}$) under high pressure "
K. Matsui, K. Yamamoto, T. Kawaai, Y. Kawamura, J. Hayashi, K. Takeda, C. Sekine
J. Phys. Soc. Jpn. **81** (2012) 104604 (7pages).

5. " Pressure suppression of unconventional charge-density-wave state in PrRu₄P₁₂ studied by optical conductivity "
H. Okamura, N. Ohta, A. Takigawa, I. Matsutori, K. Shoji, K. Miyata, M. Matsunami, T. Nanba, H. Sugawara, C. Sekine, I. Shirotni, H. Sato, T. Moriwaki, Y. Ikemoto, Z. Liu and G. L. Carr
Phys. Rev. B **85** (2012) 205116.
6. " Hall effect of Ce(Ru_{1-x}Fe_x)₂Al₁₀ single crystal "
Y. Kawamura, D. Hirai, T. Nishioka, K. Matsubayashi, Y. Uwatoko, H. Yoshizawa and C. Sekine
J. Phys.: Conf. Series **391** (2012) 012028 (4 pages).
7. " Magnetic phase diagram and crystalline electric field on NdRu₂Al₁₀ single crystal
Y. Kawamura, S. Tanimoto, T. Nishioka, H. Tanida, M. Sera, K. Matsubayashi, Y. Uwatoko
A. Kondo, K. Kindo and C. Sekine
J. Phys.: Conf. Series **391** (2012) 012029 (4 pages).

2011

1. " Magnetic properties of new filled skutterudite compounds GdFe₄As₁₂ and TbFe₄As₁₂ "
C. Sekine, K. Ito, K. Matsui and T. Yagi
J. Phys.: Conf. Ser. **273** (2011) 012120 (4 pages).
2. " Structural instability of unfilled skutterudite compounds *TSb₃* (*T*=Co, Rh and Ir) under high pressure "
K. Matsui, J. Hayashi, K. Akahira, K. Ito, Y. Fukushi, K. Takeda and C. Sekine
J. Phys.: Conf. Ser. **273** (2011) 012043 (4 pages).
3. " Magnetic phase diagram of (Pr_{1-x}Ce_x)Ru₄P₁₂ "
C. Sekine, M. Takusari and T. Yagi
J. Phys. Soc. Jpn. **80** (2011) SA024 (3 pages).
4. " High-pressure x-ray diffraction study of unfilled skutterudite compound RhAs₃ "
K. Matsui, J. Hayashi, S. Mitsuka, H. Nakamura, K. Takeda, C. Sekine
J. Phys. Soc. Jpn. **80** (2011) SA031 (3 pages).
5. " Thermal properties of filled skutterudite PrOs₄P₁₂ "
K. Matsuhira, C. Sekine, M. Wakeshima, Y. Hinatsu, H. Amitsuka, H. Mitamura, T. Sakakibara and S. Takagi
J. Phys. Soc. Jpn. **80** (2011) SA025 (3 pages).
6. " Structural and electrical properties of new filled skutterudite compound BaFe₄As₁₂ "
K. Takeda, K. Ito, J. Hyashi, C. Sekine and T. Yagi
J. Phys. Soc. Jpn. **80** (2011) SA029 (3 pages).

7. " Suppression of metal-insulator transition in PrRu₄P₁₂ under high pressure studied by infrared spectroscopy "

H. Okamura, I. Matsutori, A. Takigawa, K. Shoji, K. Miyata, M. Matsunami, H. Sugawara, H. Sato, C. Sekine, I. Shirotnani, T. Moriwaki, Y. Ikemoto and T. Nanba
 J. Phys. Soc. Jpn. **80** (2011) SA092 (3 pages).
8. " ³¹P nuclear magnetic resonance and ¹⁰¹Ru nuclear quadrupole resonance measurements of filled skutterudites GdRu₄P₁₂ and TbRu₄P₁₂ "

H. Fukazawa, R. Kobayashi, M. Shimizu, H. Amanuma, K. Hachitani, Y. Komaki, Y. Kohori, K. Akahira, C. Sekine and I. Shirotnani
 J. Phys. Soc. Jpn. **80** (2011) 044713 (5 pages).
9. " Slow dynamics of Dy pyrochlore oxides Dy₂Sn₂O₇ and Dy₂Ir₂O₇

K. Matsuhira, M. Wakeshima, Y. Hinatsu, C. Sekine, C. Paulsen, T. Sakakibara, S. Takagi,
 J. Phys.: Conf. Ser. **320** (2011) 012050 (6 pages).
10. " Spin dynamics at very low temperature in spin ice Dy₂Ti₂O₇

K. Matsuhira, C. Paulsen, E. Lhotel, C. Sekine, Z. Hiroi, S. Takagi
 J. Phys. Soc. Jpn. **80** (2011) 123711 (4 pages).

2010

1. " In-situ observation of crystallization of TSb₃ (T=Co, Rh and Ir) under high temperatures and high pressures"

C. Sekine, T. Kachi, T. Yoshida, R. Abe, T. Namiki, K. Akahira and K. Ito
 J. Phys.: Conf. Ser. **215** (2010) 012141 (4 pages).
2. " Pressure-induced irreversible isosymmetric transition of TSb₃ (T=Co, Rh and Ir) "

K. Matsui, J. Hayashi, K. Akahira, K. Ito, K. Takeda and C. Sekine
 J. Phys.: Conf. Ser. **215** (2010) 012005 (4 pages).
3. " Electrical resistivity in filled skutterudite La_xRh₄As₁₂ at high pressures "

K. Arii, H. Takahashi, H. Okada, H. Takahashi, M. Imai, T. Aoyagi, T. Kimura, C. Sekine, J. Hayashi, N. Hoshi and I. Shirotnani
 J. Phys.: Conf. Ser. **215** (2010) 012032 (4 pages).
4. " Structural and electrical properties of new filled skutterudite compound BaRu₄As₁₂ prepared at high pressure "

K. Takeda, N. Hoshi, J. Hayashi, C. Sekine, S. Kagami, I. Shirotnani and T. Yagi
 J. Phys.: Conf. Ser. **215** (2010) 012130 (5 pages).
5. " Bulk moduli of superconducting skutterudites YT₄P₁₂ (T = Fe, Ru and Os) "

J. Hayashi, K. Akahira, K. Matsui, H. Ando, Y. Sugiuchi, K. Takeda, C. Sekine, I. Shirotnani and T. Yagi
 J. Phys.: Conf. Ser. **215** (2010) 012142 (4 pages).

6. " Ferrimagnetism of New Filled Skutterudite $\text{SmFe}_4\text{As}_{12}$ Synthesized at High Pressure "
T. Namiki, C. Sekine, K. Matsuhira, M. Wakeshima and I. Shirotnani
J. Phys. Soc. Jpn., **79** (2010) 074714 (4pages).

2009

1. "Thermal Expansion of Filled Skutterudite Compound $\text{GdRu}_4\text{P}_{12}$ "
C. Sekine, K. Akahira, K. Takeda, Y. Ohishi and P. Haen,
Journal of Physics: Conf. Ser. **150** (2009) 042179 (4 pages).
2. " Pressure studies in filled skutterudite $\text{La}_{0.8}\text{Rh}_4\text{P}_{12}$ and $\text{LaRh}_4\text{As}_{12}$ "
K. Arii, K. Igawa, H. Okada, H. Takahashi, M. Imai, M. Akaishi, C. Sekine, J. Hayashi, N. Hoshi
and I. Shirotnani
J. Phys.: Conf. Ser. **150** (2009) 052009 (4 pages).
3. " ^{31}P -NMR, ^{101}Ru -NQR, μSR study of filled skutterudite $\text{TbRu}_4\text{P}_{12}$ "
H. Fukazawa, K. Hachitani, M. Shimizu, R. Kobayashi, Y. Kohori, I. Watanabe, K. Akahira, C. Sekine
and I. Shirotnani
J. Phys.: Conf. Ser. **150** (2009) 042035 (4 pages).
4. " Spin freezing in the pyrochlore antiferromagnet $\text{Pr}_2\text{Zr}_2\text{O}_7$ "
K. Matsuhira, C. Sekine, C. Paulsen, M. Wakeshima, Y. Hinatsu, T. Kitazawa, Y. Kiuchi, Z. Hiroi
and S. Takagi
J. Phys.: Conf. Ser. **145** (2009) 012031 (5 pages).
5. " Magnetic Properties of New Filled Skutterudite Compounds $\text{EuT}_4\text{As}_{12}$ ($T = \text{Fe, Ru, and Os}$)
Synthesized under High Pressure
C. Sekine, K. Akahira, K. Ito and T. Yagi
J. Phys. Soc. Jpn., **78** (2009) 093707(4pages).
6. " Elastic property of $\text{TbRu}_4\text{P}_{12}$ under pressure "
Y. Nakanishi, K. Ito, T. Kamiyama, M. Nakamura, M. Yoshizawa, M. Ohashi, G. Oomi, M.
Kosaka, C. Sekine and I. Shirotnani
Physica B: Condensed Matter, **404** (2009) 3271-3274.
7. " A Systematic Study on the Lattice Specific Heat of Filled Skutterudites "
K. Matsuhira, C. Sekine, M. Wakeshima, Y. Hinatsu, T. Namiki, K. Takeda, I. Shirotnani, H.
Sugawara, D. Kikuchi and H. Sato
J. Phys. Soc. Jpn., **78** (2009) 124601(6 pages).

2008

1. " High pressure synthesis of filled skutterudite $\text{CeOs}_4\text{As}_{12}$ "
C. Sekine, R. Abe, K. Takeda, K. Matsuhira and M. Wakeshima
Physica B: Condensed Matter., **403** (2008) 856-858.

2. " Electrical resistivity and ac-calorimetric measurements of PrRu₄P₁₂ under pressure "
A. Miyake, A.T. Holmes, T. Kagayama, K. Shimizu, C. Sekine, I. Shirotnani, D. Kikuchi, H. Sugawara and H. Sato
Physica B: Condensed Matter., **403** (2008) 1298-1300.
3. " Elastic anomalies of SmRu₄P₁₂ under high pressure and magnetic field "
P. Sun, Y. Nakanishi, T. Fujino, M. Nakamura, M. Ohashi, G. Oomi, C. Sekine, I. Shirotnani and M. Yoshizawa
Physica B: Condensed Matter., **403** (2008) 1619-1621.
4. " Direct Observation of Sm Anharmonic Motion in SmRu₄P₁₂ "
S. Tsutsui, H. Kobayashi, D. Ishikawa, J. P. Sutter, A. Q. R. Baron, T. Hasegawa, N. Ogita, M. Udagawa, Y. Yoda, H. Onodera, D. Kikuchi, H. Sugawara, C. Sekine, I. Shirotnani and H. Sato
J. Phys. Soc. Jpn., **77** (2008) 033601(4pages).
5. " Low-energy spin fluctuations in filled skutterudites YbFe₄Sb₁₂ and LaFe₄Sb₁₂ investigated through ¹²¹Sb nuclear quadrupole and ¹³⁹La nuclear magnetic resonance measurements"
A. Yamamoto, S. Iemura, S. Wada, K. Ishida, I. Shirotnani, and C. Sekine
Journal of Physics: Condensed Matter, **20** (2008) 195214(8 pages).
6. " Magnetic Properties of Filled Skutterudite Phosphides with Heavy Lanthanides Synthesized under High Pressure "
C. Sekine, H. Ando, Y. Sugiuchi, I. Shirotnani, K. Matsuhira and M. Wakeshima,,
J. Phys. Soc. Jpn., **77** Suppl. A (2008) 135-141.
7. " Exploring Characteristic Electronic States in Filled Skutterudites by Ultrasonic Measurements ? Multipole Ordered State in SmRu₄P₁₂? "
M. Yoshizawa, P. Sun, M. Nakamura, Y. Nakanishi, C. Sekine, I. Shirotnani, D. Kikuchi, H. Sugawara and H. Sato
J. Phys. Soc. Jpn., **77** Suppl. A (2008) 84-89.
8. " Guest Ion Motion in Cage Structure Crystals Investigated by Raman Scattering "
M. Udagawa, T. Hasegawa, Y. Takasu, N. Ogita, K. Suekuni, M. A. Avila, T. Takabatake, Y. Ishikawa, N. Takeda, Y. Nemoto, T. Goto, H. Sugawara, D. Kikuchi, H. Sato, C. Sekine, I. Shirotnani, J. Yamaura, Y. Nagao and Z. Hiroi
J. Phys. Soc. Jpn., **77** Suppl. A (2008) 142-147.
9. " Pressure Effect on Pr-based Skutterudite Compounds "
A. Irizawa, K. Shimai, K. Sato, M. Kobayashi, T. Murakami, H. Okamura, T. Nanba, M. Matsunami, C. Sekine and I. Shirotnani
J. Phys. Soc. Jpn., **77** Suppl. A (2008) 214-215.
10. " ⁷⁵As-NQR Studies of Filled-Skutterudites PrRu₄As₁₂ and LaRu₄As₁₂ "
M. Shimizu, H. Amanuma, K. Hachitani, H. Fukazawa, Y. Kohori, T. Namiki, C. Sekine and I. Shirotnani

11. " Effect of Rare-Earth Filling Rate for the Physical Properties of Skutterudites Investigated through NMR/NQR Measurements "
S. Iemura, A. Yamamoto, S. Wada, I. Shirotni and C. Sekine,
J. Phys. Soc. Jpn., **77** Suppl. A (2008) 235-237.
12. " Raman Scattering Study of Filled Skutterudite Compounds "
N. Ogita, R. Kojima, T. Hasegawa, Y. Takasu, M. Udagawa, T. Kondo, S. Narazu, T. Takabatake,
N. Takeda, Y. Ishikawa, H. Sugawara, T. Ikeno, D. Kikuchi, H. Sato, C. Sekine and I. Shirotni,
J. Phys. Soc. Jpn., **77** Suppl. A (2008) 251-253.
13. " Investigation of the Anharmonic Guest Modes in Filled Skutterudites Using Inelastic X-ray Scattering Techniques "
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