

APAC SILICIDE 2019 PROGRAM

July 20, 2019

13:00—13:10 **Opening address**, Prof. Haruhiko Uono, *Chair of APAC-SILICIDE 2019*

Session Sat-1 Ca-silicides and clathrates (Chair: Prof.H. Tatsuoka, Prof.T. Kume)

13:15—13:45 [**Sat-p-I1**] *Invited*

Semitransparent and conductive CaSi_2 films for silicon device applications

Prof. Nikolay Galkin

Russian Academy of Science, Russia

13:45—14:15 [**Sat-p-I2**] *Invited*

Semiconducting ternary Si clathrates

Dr. Motoharu Imai

National Institute for Materials Science, Japan

14:15—14:30 [**Sat-p-O1**]

Growth of Ge Clathrate on Sapphire and Optical Properties

Rahul Kumar, T. Maeda, Y. Hazama, F. Ohashi, H. S. Jha, T. Kume

Gifu University, Japan

14:30—14:45 [**Sat-p-O2**]

Sacrificial growth in $\text{Ca}_2\text{Si}(010)/\text{Mg}_2\text{Si}(111)/\text{Si}(111)$ system: morphology, atomic structure and optical properties of Ca_2Si epitaxial films

K.N. Galkin, N.G. Galkin, S.A. Dotsenko, E.Y.Subbotin, E.A.Chusovitin

Russian Academy of Science, Russia

14:45—15:00 [**Sat-p-O3**]

Growth and fluorination of a $\text{tr}6\text{-CaSi}_2$ thin layer

Kenji Ito¹, Tetsu Ohsuna¹, Takashi Suemasu² and Hideyuki Nakano¹

¹*Toyota R&D, Japan*, ²*University of Tsukuba, Japan*

15:00—15:15 [**Sat-p-O4**]

Synthesis of Si Nanowire/Nanosheet Complex Structures from CaSi_2 crystals by Thermal Treatment under $\text{MnCl}_2/\text{NH}_4\text{Cl}$ Vapors

Shogo Itoh¹, Yushin Numazawa¹, Yoshiki Ono¹, Yalei Huang¹, Yosuke Shimura¹,

Hirokazu Tatsuoka¹, and Naohisa Takahashi⁴

¹*Shizuoka University, Japan* ²*Yamaha, Japan*

Break 15:15—15:30

15:30—17:30 **Poster Session** (Chair: Dr. K. Yamaguchi)

July 21, 2019

Session Sun-2 Silicides for optical applications I (Chair: Prof. D. Migas, Dr. O. Isabera)

8:45— 9:15 [**Sun-a-I3**] *Invited*

Electronic and defect properties of semiconducting barium disilicide

Dr. Naoto Umezawa

National Institute for Materials Science, Japan

9:15— 9:30 [**Sun-a-O5**]

Electron paramagnetic resonance spectra of BaSi₂ epitaxial films and bulk samples

T. Sato^{1,2}, Y. Yamashita¹, Z. Xu¹, L. Benincasa^{1,2}, K. Toko¹, S. Gambarelli², T. Suemasu¹

¹*University of Tsukuba, Japan*, ²*University of Grenoble-Alpes, France*

9:30— 9:45 [**Sun-a-O6**]

Significant improvement on photoresponsivity and minority carrier lifetime of atomic H passivated BaSi₂ epitaxial films

Z. Xu¹, K. Gotoh², T. Deng¹, K. Toko¹, N. Usami², D. Migas³, T. Suemasu¹

¹*University of Tsukuba, Japan*, ²*Nagoya University, Japan*

³*Belarusian State University of Informatics and Radioelectronics, Belarus*

9:45—10:00 [**Sun-a-O7**]

The interrelation of optical and photoelectric properties in SPE grown BaSi₂ films on Si(111) substrates and photodiode structures on their base

N.G. Galkin^{1,2}, D.L. Goroshko¹, V.L. Dubov², D.V. Fomin², K.N. Galkin¹,

E.A.Chusovitin¹, S.V. Chusovitina¹

¹*Russian Academy of Science, Russia*, ²*Amur State University, Russia*

10:00—10:15 [**Sun-a-O8**]

Investigation of defect levels in undoped-BaSi₂ epitaxial films and the effect of atomic hydrogen passivation by photoluminescence measurement

L. Benincasa^{1,2}, H. Hoshida³, T. Deng¹, T. Sato^{1,2}, Z. Xu¹, K. Toko¹, Y. Terai³, and T. Suemasu¹

¹*University of Tsukuba, Japan*, ²*University of Grenoble-Alpes, France*

³*Kyushu Institute of Technology, Japan*

Break 10:15—10:30

Session Sun-3 Silicides for optical applications II (Chair: Prof. T. Suemasu, Prof. H. Udono)

10:30—11:00 [**Sun-a-I4**] *Invited*

Recent advancements in the development and characterization of BaSi₂ for photovoltaic applications

Dr. Olindo Isabella

Delft University of Technology, The Netherlands

11:00—11:15 [**Sun-a-O9**]

Physicochemical study of BaSi₂ evaporation for composition-controlled film deposition

Kosuke O. Hara, Keisuke Arimoto, Junji Yamanaka, and Kiyokazu Nakagawa

University of Yamanashi, Japan

11:15—11:30 [**Sun-a-O10**]

Influence of the time-dependent vapor composition on structural properties of the BaSi₂ thin films fabricated by vacuum evaporation

T. Yoshino, Y. Kimura, M. Fujiwara, Y. Nakagawa, Y. Kurokawa, N. Usami
Nagoya University, Japan

11:30—11:45 [**Sun-a-O11**]

Molecular Beam Epitaxy of High-quality Undoped BaSi₂ Light Absorbers using Three-step Growth Method

Yudai Yamashita, Takuma Sato, Kaoru Toko, Takashi Suemasu
University of Tsukuba, Japan

11:45—12:00 [**Sun-a-O12**]

Fabrication of As-doped n-type BaSi₂ Films Grown by Molecular Beam Epitaxy

Sho Aonuki, Yudai Yamashita, Kaoru Toko and Takashi Suemasu
University of Tsukuba, Japan

12:00—12:15 [**Sun-a-O13**]

Temperature Dependent Spectral Photosensitivity of Mg₂Si pn-junction Photodiodes

D. Niioka¹, F. Takahashi¹, M. Yoshida², D. Tsuya², H. Udono¹
¹*Ibaraki University, Japan*, ²*National Institute for Materials Science, Japan*

12:15—12:30 [**Sun-a-O14**]

Photoreflectance spectra of highly-oriented Mg₂Si(111)//Si(111) films

R. Kinoshita¹, H. Hoshida¹, A. Shevlyagin², I. Chernev², A. Gouralnik², and Y. Terai¹
¹*Kyushu Institute of Technology, Japan*, ²*Russian Academy of Science, Russia*

Lunch Break 12:30—13:30

Session Sun-4 Thermoelectric materials I (Chair: Prof. Y. Miyazaki, Prof. M. Zebarjadi)

13:30—14:00 [**Sun-p-I5**] *Invited*

Thermoelectric Properties of Nanocrystalline Silicon using Recycled Silicon Sawing Waste

Dr. Gabi Schierning
Leibniz-Institute IFW Dresden, Germany

14:00—14:30 [**Sun-p-I6**] *Invited*

Potential of Nanostructured Silicon for Thermoelectrics

Prof. Ken Kurosaki
Kyoto University, Japan

14:30—14:45 [**Sun-p-O15**]

High Thermoelectric Performance of Flexible p-type SiGe Films Formed by High Impurity Doping Technique

Mikie Tsuji, Kinta Kusano, Takashi Suemasu, and Kaoru Toko
University of Tsukuba, Japan

14:45—15:00 [**Sun-p-O16**]

Thermoelectric Properties of Heavily doped Nano-structured n-type Silicon-Germanium Alloys

S. Ghodke¹, M. Omprakash¹, K. Delime-Codrin¹, M. Adachi³, M. Kiyama³, T. Matsuura³, Y. Yamamoto³, and T. Takeuchi^{1,2}

¹*Toyota Technological Institute, Japan*, ²*PRESTO-JST, Japan*

³*Sumitomo Electric Industries, Ltd.*

15:00—15:15 [**Sun-p-O17**]

Effects of precipitated fine secondary phase on thermoelectric properties of CrSi₂

Kai Uemura, Masaaki Baba, and Masatoshi Takeda

Nagaoka University of Technology, Japan

Break 15:15—15:35

Session Sun-5 Thermoelectric materials II (Chair: Prof. K. Kurosaki, Dr. G. Schierning)

15:35—16:05 [**Sun-p-I7**] *Invited*

Recent progress in silicide thermoelectric materials

Prof. Yuzuru Miyazaki

Tohoku University, Japan

16:05—16:35 [**Sun-p-I8**] *Invited*

Thermoelectric transport at organic-silicon interface

Prof. Mona Zebarjadi

University of Virginia, USA

16:35—16:50 [**Sun-p-O18**]

Local structures of Sb and Ag in Mg₂Si crystals studied by EXAFS analysis

M. Kitaura¹, T. Ina², M. Ishizaki¹, T. Tanimoto¹, Y. Fuse³, R. Masubuchi³, H. Uono³, A. Ohnishi¹, K. Hara⁴

¹*Yamagata University, Japan*, ²*JASRI/SPring-8, Japan*, ³*Ibaraki University, Japan*

⁴*Shizuoka University, Japan*

16:50—17:05 [**Sun-p-O19**]

Preparation of Mg₂Si-based thin films and these properties

A. Katagiri¹, M. Uehara¹, T. Shimizu¹, M. Matsushima¹, K. Akiyama^{1,2}, H. Uchida³, Y. Kimura¹, H. Funakubo¹

¹*Tokyo Institute of Technology, Japan*, ²*Kanagawa Institute of Industrial Science and Technology, Japan*, ³*Sophia University, Japan*

16:05—17:20 [**Sun-p-O20**]

Thermoelectric properties of doped n-type Mg₂Si with antimony and isoelectric impurities

H. Kakio, T. Iida, D. Shiojiri, S. Shiba and M. Nakatani

Tokyo University of Science, Japan

17:20—17:35 [**Sun-p-O21**]

Thermoelectric property of $M_xSr_{1-x}Si_2$ ($M = Ca, Ba$) film prepared by co-sputtering method

Kodai Aoyama¹, Takao Shimizu¹, Hideto Kuramochi², Masami Mesuda², Ryo Akiike², Keisuke Ide¹, Takayoshi Katase¹, Toshio Kamiya¹, Yoshisato Kimura¹, and Hiroshi Funakubo¹

¹*Tokyo Institute of Technology, Japan*, ²*Tosoh corporation, Japan*

18:00— 18:15 **Transfer to Cottage Himuka**

18:30— 20:30 **Banquet (Cottage Himuka, BBQ at Poolside)**

July 22, 2019

Session Mon-6 Low-dimensional materials I (Chair: Prof. N.G. Galkin, Prof. Y. Nakamura)

9:00—9:30 [Mon-a-I9] *Invited*

Possible 2D-like silicides: structure and electronic properties

Prof. Dimitri Migas

Belarusian State University of Info. & Radioelec., Belarus

9:30—10:00 [Mon-a-I10] *Invited*

Silicide and germanide formation in nanowires

Prof. Yi-Chia Chou

National Chiao Tung University (NCTU), Taiwan

10:00—10:15 [Mon-a-O22]

Improving Crystal and Electrical Properties of Multilayer Graphene on Insulator formed by Ni-Induced Layer Exchange

Hiromasa Murata, Yoshiki Nakajima, Takashi Suemasu, and Kaoru Toko

University of Tsukuba, Japan

10:15—10:30 [Mon-a-O23]

Tuning magnetic, transport and optical properties of FeSi₂ nanocrystals: impact of gold and Si/Fe flux ratio

I. Tarasov¹, T. Smolyarova^{1,2}, I. Nemtsev¹, I. Yakovlev¹, M. Volochaev¹, L. Solovyov¹, S. Varnakov¹, S. Ovchinnikov^{1,2}

¹*Russian Academy of Science, Russia*, ²*Siberian Federal University, Russia*

Break 10:30—10:50

Session Mon-7 Low-dimensional materials II (Chair: Prof. Yi-C. Chou, Prof. Y. Terai)

10:50—11:05 [Mon-a-O24]

Fabrication and evaluation of lateral type spin-valves comprising epitaxially-grown β -FeSi₂ layers

T. Sakai¹, H. Ishimoto¹, T. Tabei², K. Sakai³, T. Yoshitake¹

¹*Kyushu University, Japan*, ²*Hiroshima University, Japan*, ³*Kurume College, Japan*

11:05—11:20 [Mon-a-O25]

Formation of high density Fe-silicide nanodots induced by remote H₂ plasma and their magnetic properties

Y. Hashimoto¹, K. Makihara¹, M. Ikeda¹, A. Ohta¹, A. Kohno², S. Miyazaki¹

¹*Nagoya University, Japan*, ²*Fukuoka University, Japan*

12:00— 18:00 **Excursion**

July 23, 2019

Session Tues-8 Growth of materials I (Chair: Dr. M. Imai, Prof. K. Hara)

9:00—9:15 [Tue-a-O26]

High-Pressure Synthesis and Superconductivity of Solid Solutions of LuGe₃ and YGe₃ with a Layered Structure

Hiroshi Fukuoka, Ryoya Hino, and Kei Inumaru

Hiroshima University, Japan

9:15—9:30 [Tue-a-O27]

Crystal structure and electrical resistivity of NaPd₃Ge₂

Takahiro Yamada^{1,2}, Kohei Aiba¹, Daigoro Hirai³, Zenji Hiroi³, Hisanori Yamane¹

¹Tohoku University, Japan, ²PRESTO-JST, Japan, ³University of Tokyo, Japan

9:30—9:45 [Tue-a-O28]

Solid-phase Crystallization of As-doped Amorphous Ge on Insulator Leading to the Highest Electron Mobility

M. Saito, K. Moto, T. Nishida, T. Suemasu, and K. Toko

University of Tsukuba, Japan

9:45—10:00 [Tue-a-O29]

Formation of Mg₂Si_{1-x}Sn_x Thin Films by Co-sputtering and Their p-Type Electrical Conduction

Syotaro Fuse and Hiroshi Katsumata

Meiji University, Japan

Break 10:00—10:20

Session Tues-9 Growth of materials II (Chair: Prof. T. Yoshitake, Prof. T. Yamada)

10:20—10:35 [Tue-a-O30]

Synthesis of Mg₂Asi thin film by thermal treatment under inert gas atmosphere and evaluation of film quality

I. Horiba, F. Michinobu, Y. Nakagawa, K. Gotoh, Y. Kurokawa, N. Usami

Nagoya University, Japan

10:35—10:50 [Tue-a-O31]

Photoresponsivity of a Pseudo-single-crystal GaAs Film Synthesized on Glass Using a Large-grained Ge Seed Layer for Solar Cell Applications

Takeshi Nishida, Kenta Moto, Takashi Suemasu, and Kaoru Toko

University of Tsukuba, Japan

10:50—11:05 [Tue-a-O32]

Large-grained Polycrystalline Germanium Thin Films on Insulators with the Highest Hole Mobility

Toshifumi Imajo, Kenta Moto, Takashi Suemasu, Kaoru Toko

University of Tsukuba, Japan

11:30—12:00 **Closing and Ceremony**

APAC SILICIDE 2019 Poster Session

July 20, 2019

15:30—17:30 Poster session (Chari: Dr. K. Yamaguchi)

P1 Drastic enhancement of photoresponsivity in C-doped BaSi₂ films formed by radio-frequency sputtering

T. Nemoto¹, S. Matsuno¹, M. Mesuda², H. Kuramochi², K. Toko¹, and T. Suemasu¹

¹University of Tsukuba, Japan, ²Tosoh Corporation, Japan

P2 Effect of BaSi₂ template fabrication methods on the performance of p-BaSi₂/n-Si heterojunction solar cells

R. Sugiyama, K. Toko, and T. Suemasu

University of Tsukuba, Japan

P3 Vacuum evaporation of BaSi₂ thin films on textured Si(100) substrates

Y. Naito, S. Nishio, and K. Nishino

Tokushima University, Japan

P4 Influence of post annealing conditions on carrier density of undoped evaporated BaSi₂ films

Y. Kimura, M. Fujiwara, Y. Nakagawa, K. Gotoh, Y. Kurokawa, and N. Usami

Nagoya University, Japan

P5 Influence of Ba to Si rate ratio on the properties of B-doped BaSi₂ epitaxial films

S. Sugiyama¹, Y. Kimura², Y. Yamashita¹, K. Toko¹, N. Usami², and T. Suemasu¹

¹University of Tsukuba, Japan, ²Nagoya University, Japan

P6 Ca substitution effects on crystal structure and bandgap in BaSi₂

M. Imai

National Institute for Materials Science, Japan

P7 Simultaneous realization of thermoelectric power factor enhancement and thermal conductivity reduction in epitaxial Si films containing β -FeSi₂ nanodots

S. Sakane¹, T. Ishibe¹, N. Naruse², Y. Mera², Md. Mahfuz Alam³, K. Sawano³, N. Mori^{1,4}, and Y. Nakamura^{1,4}

¹Osaka University, Japan, ²Shiga University of Medical Science, Japan,

³Tokyo City University, Japan, ⁴CREST-JST, Japan

P8 Photoluminescence properties of polycrystalline β -FeSi₂ grown by RF magnetron sputtering

H. Nishi, N. Oka, and Y. Terai

Kyushu Institute of Technology, Japan

P9 Dependence of electrical conduction properties on activation conditions in Sb-doped β -FeSi₂ epitaxial films

M. Abe, H. Eguchi, H. Hoshida, and Y. Terai

Kyushu Institute of Technology, Japan

P10 Structural, Optical and AC Conductivity Studies on Amorphous-Si/ β -FeSi₂ Composite Thin Films

Y. Saito and H. Katsumata
Meiji University, Japan

P11 Epitaxial growth of β -FeSi₂ thin films prepared by co-sputtering with high purity Fe and Si targets

Y. Tanaka¹, S. Uchida¹, T. Yoshida², and T. Yoshitake¹
¹*Kyushu University, Japan*, ²*Fukuoka Industrial Technology Center, Japan*

P12 Local and non-local spin valves in Fe₃Si/FeSi₂/Fe₃Si trilayer films

K. Sakai¹, T. Sakai², M. Nishijima³, and T. Yoshitake²
¹*Kurume College, Japan*, ²*Kyushu Univ., Japan*, ³*Tohoku Univ., Japan*

P13 First principle band calculations of Mg₂Si thin films

M. Takizawa, T. Komine, H. Uono, and T. Aono
Ibaraki University, Japan

P14 Change of the band structure of Mg₂Si induced by interstitial doping with non-metallic elements

Y. Imai¹, A. Yamamoto¹, and K. Takarabe²
¹*AIST, Japan*
²*Okayama University of Science, Japan*

P15 Signatures of Mg₉Si₅ phase in Mg₂Si films grown by different epitaxy modes: existence and method to control that

A. V. Shevlyagin¹, I. M. Chernev¹, A. S. Gournik¹, S. A. Balagan¹, A. V. Gerasimenko¹, and T. D. Huan^{2,3}
¹*Russian Academy of Science, Russia*, ²*Georgia Institute of Technology, USA*
³*University of Connecticut, USA*

P16 A simple and non-destructive method to determine the thickness of Mg₂Si films grown on Si substrates: recalibration of Mg sublimation source and the ways to increase its efficiency

I. M. Chernev, A. V. Shevlyagin, A. S. Gournik, A. K. Gutakovskii, and A. V. Gerasimenko
Russian Academy of Science, Russia

P17 Comparison of crystalline quality and electrical property of Mg₂Si crystals grown using PBN and PG graphite crucible

Y. Fuse, R. Masubuchi, T. Ishikawa, K. Gosyuu, and H. Uono
Ibaraki University, Japan

P18 Temperature dependence of lifetime measured in Mg₂Si pn-junction photodiodes by OCVD method

F. Takahashi, D. Niioka, T. Miyauchi, and H. Uono
Ibaraki University, Japan

P19 Comparison of absorption coefficient of high purity n-type Mg₂Si crystal and spectral photosensitivity of Mg₂Si pn junction photodiode

T. Miyauchi, D. Niioka, F. Takahashi, Y. Onizawa, and H. Uono
Ibaraki University, Japan

P20 Observation of crystal defects in Mg₂Si single crystals by wet-etching technique using diluted Fluonitric acid

R. Masubuchi, Y. Fuse, and H. Udono

Ibaraki University, Japan

P21 Surface photovoltage effect on Mg₂Si single crystals

T. Tanimoto¹, M. Kitaura¹, J. Azuma², I. Yamamoto², M. Imamura², K. Takahashi², H. Udono³, M. Ishizaki¹, A. Ohnishi¹, and K. Hara⁴

¹*Yamagata University, Japan*, ²*JASRI/SPring-8, Japan*, ³*Ibaraki University, Japan*

⁴*Shizuoka University, Japan*

P22 Effect of irradiation conditions on the film growth of iron oxide on Si substrate by ion beam sputter deposition method

K. Yamanaka^{1,2}, and K. Yamaguchi²

¹*Ibaraki University, Japan*, ²*QST, Japan*

P23 Observation of Magnesium-Induced Crystallization (Mg-MIC) of a-Si Thin Film

T. Ikehata, R. Sasajima, M. Saijo, N. Sato, and H. Udono

Ibaraki University, Japan

P24 Transfer Free Synthesis of Multilayer Graphene on Insulator: Comprehensive Study of Carbon/metal Solid-phase Reaction

Y. Nakajima, H. Murata, T. Suemasu, and K. Toko

University of Tsukuba, Japan

P25 Optical Properties of Amorphous and Nanocrystalline SiC Embedded in Silicon Oxide Films Prepared by Co-sputtering

R. Narimatsu, K. Morimoto, and H. Katsumata

Meiji University, Japan

P26 Rapid solid state reaction synthesis of nanostructured Mg₂Si via activated reactive mechanical milling at room temperature

B. Alinejad, Y. Yamamoto, and T. Ikeda

Ibaraki University, Japan

P27 Formation and properties of doped silicon nanostructures with embedded GaSb nanocrystals for thermoelectric application,

D. L. Goroshko¹, E. V. Chusovitin¹, E. Y. Sobbotin¹, S. V. Chusovitina¹, S. A. Balagan¹, K. N. Galkin¹, S. A. Dotsenko¹, A. K. Gutakovskii¹, V. V. Khovaylo², and N. N. Galkin¹

¹*Russian Academy of Science, Russia*, ²*National University of Science and Technology MISiS, Russia*

P28 Growth and thermoelectric properties of composite thin films based on higher iron and manganese silicides

I. Tarasov¹, I. Yakovlev¹, M. Volochaev¹, T. Smolyarova^{1,2}, A. Fedorov¹, S. Varnakov¹, and S. Ovchinnikov^{1,2}

¹*Russian Academy of Science, Russia*, ²*Siberian Federal University, Russia*

P29 Structural analysis of guest free type II Si-Ge clathrate,
H. Hisamatsu, K. Yamada, F. Ohashi, H. S. Jha, and T. Kume
Gifu University, Japan

P30 XRD investigation of lithium silicide under high pressure
H. Iwasa, S. Ikemoto, F. Ohashi, H. S. Jha, and T. Kume
Gifu University, Japan

P31 Electronic properties of Na doped type II Ge clathrate film grown on sapphire substrate,
R. Tanahashi, Y. Hazama, F. Ohashi, H. Shekher Jha, and T. Kume
Gifu University, Japan

P32 Growth of Si Clathrate Films with Various Annealing Conditions,
K. Tanaka, R. Kumar, T. Maeda, F. Ohashi, H. S. Jha, and T. Kume
Gifu University, Japan

P33 Synthesis of CaF₂ Nanostructures from Calcium Silicide Powders in Diluted Aquarius HF Solution,
Y. Ono¹, Y. Numazawa¹, S. Itoh¹, Y. Huang¹, Y. Shimura¹, H. Tatsuoka¹, and N. Takahashi²
¹*Shizuoka University, Japan*, ²*Yamaha, Japan*

P34 Topological Synthesis of Mg-based Silicate Nanosheets from CaSi₂ crystals,
Y. Numazawa, S. Itoh, Y. Ono, Y. Huang, Y. Shimura, and H. Tatsuoka
Shizuoka University

P35 Cross-sectional characterization of Mg₂Si / Ni compacted with spark plasma sintering at 800°C
T. Ishii, H. Sugawara, M. Tokuda, H. Sato, T. Hanajiri, H. Shimoshige, S. Kurosu, K. Hayashi, I. Ando, W. Saito, and Y. Miyazaki
¹*Tokyo Metropolitan University, Japan*, ²*Toyo University, Japan*, ³*Tohoku University, Japan*.