

**The First International Conference on  
Automated Flow and Microreactor Synthesis  
(ICAMS-1)**

*January 18 to 20, 2018  
Osaka, Japan*

**Programs**

## **Organized by:**

Group for Research on Automated Flow and Microreactor Synthesis, Kinka Chemical Society, Japan

## **Organizing Committee:**

Jun-ichi Yoshida	(Kyoto University)
Koichi Fukase	(Osaka University)
Toshiyuki Iwai	(Osaka Research Institute of Industrial Science and Technology)
Kiyomi Kakiuchi	(Nara Institute of Science and Technology)
Hirofumi Kuroda	(Eisai Co., Ltd.)
Hitoshi Mitsui	(MiChS Co., Ltd.)
Hajime Mori	(Industrial Technology Center of Wakayama Prefecture)
Akihiro Orita	(Okayama University of Science)
Ilhyong Ryu	(Osaka Prefecture University)
Tadahisa Sato	(Nano Innovation Laboratories Co., Ltd.)
Shoichi Shimizu	(Nihon University)
Seiji Suga	(Okayama University)
Masashi Taga	(Kyowa Hakko Kirin Co., Ltd.)
Masami Takayama	(Shionogi Co., Ltd.)
Masahiro Takeda	(Sumitomo Chemical Co., Ltd.)
Hirotsugu Usutani	(Takeda Pharmaceutical Co., Ltd.)

## **Executive Committee:**

Aiichiro Nagaki	(Kyoto University)
Takahide Fukuyama	(Osaka Prefecture University)
Yoshiyuki Manabe	(Osaka University)

## **Supported by:**

Grant-in-Aid for Scientific Research (S) (No. 26220804)  
“Deeping and Developing New Aspects of Flash Chemistry.”  
Kinka Chemical Society, Japan  
Osaka Industrial Research Association  
Kansai Branch, The Society of Chemical Engineers, Japan  
The Japanese Society for Process Chemistry  
The Society of Polymer Science, Japan (SPSJ) Kansai Regional Chapter  
Kansai Branch, Chemical Society of Japan  
The Pharmaceutical Society of Japan Kinki Branch  
Kansai Branch, The Society of Synthetic Organic Chemistry, Japan

# Program Summary

January 18 p.m.		January 19 a.m.		January 19 p.m.		January 20 a.m.	
13:00	Opening Remarks	9:00	PL2 Timothy F. Jamison			9:00	KL5 Andrew Rutter
10	PL1 Volker Hessel	10				10	
20		20				20	
30		30		13:30	Poster Session	30	
40		40		40		40	IL7 Hiroyuki Miyamura
50		50		50		50	
14:00		10:00	KL2 Yangcheng Lu	14:00		10:00	IL8 Yasuhiro Nishiyama
10	IL1 Shinichiro Fuse	10		10		10	
20		20		20		20	Coffee Break
30	IL2 Takashi Fukuyama	30		30		30	
40		40	Coffee Break	40		40	
50	Coffee Break	50		50		50	PL4 Koichi Fukase
15:00		11:00	KL3 Leslaw Mieczko	15:00	KL4 Joerg Sedelmeier	11:00	
10	KL1 John R. Naber	10		10		10	
20		20		20		20	
30		30		30		30	
40		40	IL6 Yuichi Nakahara	40		40	
50	IL3 Heejin Kim	50		50	PL3 C. Oliver Kappe	50	Closing Remarks
16:00		12:00	Lunch	16:00		12:00	
10	IL4 Hiroaki Yasukouchi	10		10			
20		20		20			
30	IL5 Hirotsugu Usutani	30		30			
40		40		40			
50	Dohgane Award	50		50			
17:00		13:00		17:00	Banquet		
		10		10			
		20		20			
		30		30			
				40			
				50			
				18:00			
				10			
				20			
				30			
				40			
				50			
				19:00			

All scientific program will be held at  
 “Orbit Hall”, B1 floor, main building  
 Hotel Hankyu Expo Park  
 1-5 Senri-Banpaku-Koen, Suita-City, Osaka 565-0826, Japan

# Program

## January 18 (Thursday)

- 13:00-13:10    **Opening Remarks**
- 13:10-14:10    **PL-1**            Pharmaceutical Flow Chemistry: Multiple Steps in Multiple Flows and in ONE-FLOW, with Smart On-line PAT-Quality Control  
**Volker Hessel** (Eindhoven University of Technology, the Netherlands)
- 14:10-14:30    **IL-1**            Highly Efficient Amide Bond Formation Using Micro-flow Technology  
**Shinichiro Fuse** (Tokyo Institute of Technology, Japan)
- 14:30-14:50    **IL-2**            Application of Continuous Flow for the Synthesis of Eribulin Mesylate  
**Takashi Fukuyama** (Eisai Co.,Ltd., Japan)
- 14:50-15:10    *Coffee Break*
- 15:10-15:50    **KL-1**            Recent Applications in Flow Chemistry at MSD  
**John R. Naber** (Merck & Co. Inc., USA)
- 15:50-16:10    **IL-3**            Control of Rapid Rearrangements and Synthetic Applications Using Flow Microreactors  
**Heejin Kim** (Kyoto University, Japan)
- 16:10-16:30    **IL-4**            Flow Reactor System for Phosgene Reaction  
**Hiroaki Yasukouchi** (Kaneka Corp., Japan)
- 16:30-16:50    **IL-5**            Development and Scale-Up of a Flow Flash Chemistry Process for a Key Boronic Acid Intermediate  
**Hirotsugu Usutani** (Takeda Pharmaceutical Co., Ltd., Japan)
- 16:50-17:00    *Dohgane Award Ceremony*  
Awardee:  
**David G. Cork** (Formerly of Takeda Pharmaceutical Co., Japan)

## **January 19 (Friday)**

- 9:00-10:00    **PL-2**            The When, Why, and How of Flow Chemistry  
**Timothy F. Jamison** (Massachusetts Institute of Technology, USA)
- 10:00-10:40   **KL-2**            Micromixer Assisted Cationic Polymerization  
**Yangcheng Lu** (Tsinghua University, China)
- 10:40-11:00   *Coffee Break*
- 11:00-11:40   **KL-3**            Technology Development for Continuous Synthesis of Fine  
Chemicals - Industrial Perspective  
**Leslaw Mleczko** (Bayer AG, Germany)
- 11:40-12:00   **IL-6**            Fundamental Technologies for Flow Microreactors -Accelerate the  
Industrial Application-  
**Yuichi Nakahara** (Ajinomoto Co., Inc., Japan)
- 12:00-13:30   *Lunch*
- 13:30-14:50                    **Poster Session**
- 15:00-15:40   **KL-4**            Continuous Manufacturing at Novartis Pharma  
**Joerg Sedelmeier** (Novartis Pharma AG, Switzerland)
- 15:40-16:40   **PL-3**            Organic Synthesis Goes Flow – The Use of Continuous Flow  
Technology for the Synthesis of Active Pharmaceutical Ingredients  
**C. Oliver Kappe** (University of Graz, Austria)
- 17:00-19:00    *Banquet*  
                  “Seiun”, 2nd floor, main building  
                  Hotel Hankyu Expo Park

**January 20 (Saturday)**

- |             |                        |   |
|-------------|------------------------|---|
| 9:00-9:40   | <b>KL-5</b>            | The Evolution of Continuous Manufacturing Concepts for the Manufacture of Active Pharmaceutical Ingredients<br><b>Andrew Rutter</b> (GSK R&D, UK)                                       |
| 9:40-10:00  | <b>IL-7</b>            | Development of Heterogeneous Metal Nanoparticle Catalysts toward Continuous-flow Reactions<br><b>Hiroyuki Miyamura</b> (The University of Tokyo, Japan)                                 |
| 10:00-10:20 | <b>IL-8</b>            | Improvement of Photoreaction Efficiency in Flow Microreactors by using Hg Lamp or Visible LED Lamp<br><b>Yasuhiro Nishiyama</b> (Industrial Technology Center of Wakayama Pref., Japan) |
| 10:20-10:40 | <i>Coffee Break</i>    |   |
| 10:40-11:40 | <b>PL-4</b>            | Synthesis of Biofunctional Glycans Using Integrated Reaction Systems<br><b>Koichi Fukase</b> (Osaka University, Japan)  |
| 11:40-11:50 | <b>Closing Remarks</b> |   |

## Poster Presentations

**PXX:** ICAMS-1 Student Poster Award Nominee

**P1** Structure-Activity Relationship Studies of Maitotoxin Based on Chemical Synthesis of Partial Structures

**Tohru Oishi** (Kyushu University)

**P2** A Three-Minute Sequential Difunctionalization of 2,5-Norbornadiene Using Flow Microreactor

**Zuoyufan Yin** (Osaka University), Heejin Kim (Kyoto University), Jun-ichi Yoshida (Kyoto University), Hidehiro Sakurai (Osaka University)

**P3** Rapid and Mild Synthesis of Amino Acid *N*-Carboxy Anhydrides Using Basic-to-Acidic Flash Switching in a Micro-flow Reactor

**Yuma Otake** (Tokyo Institute of Technology), Hiroyuki Nakamura (Tokyo Institute of Technology), Shinichiro Fuse (Tokyo Institute of Technology)

**P4** Study of Aerobic Photooxidation with Slug-Flow Microreactor

**Akichika Itoh** (Gifu Pharmaceutical University), Yoshitomo Nagasawa (Gifu Pharmaceutical University)

**P5** Phase-Transfer Catalyzed Nucleophilic Aromatic Substitution in a Continuous-flow Microreactor

**Hajime Mori** (Industrial Technology Center of Wakayama Prefecture), Akane Saito (Industrial Technology Center of Wakayama Prefecture), Yasuhiro Nishiyama (Industrial Technology Center of Wakayama Prefecture), Koji Machitani (Industrial Technology Center of Wakayama Prefecture)

**P6** Regioselective Intramolecular [2+2] Photocycloaddition of 1-Cyanonaphthalenes Bearing Cycloalkenyl Groups Using Flow Microreactor

**Kazuhiko Mizuno** (Nara Institute of Science and Technology), Jiro Noguchi (Nara Institute of Science and Technology), Momoe Nakano (Nara Institute of Science and Technology), Yasuhiro Nishiyama (Ind. Tech. Center of Wakayama Pref.), Hajime Maeda (Kanazawa University), Kiyomi Kakiuchi (Nara Institute of Science and Technology)

**P7** Improvement of Organic Photoreaction Efficiency by Difference of Refractive Index of Each Segment in Slug Flow Mode

**Jiro Noguchi** (Nara Institute of Science and Technology), Momoe Nakano (Nara Institute of Science and Technology), Yasuhiro Nishiyama (Nara Institute of Science and Technology), Industrial Technology Center of Wakayama Prefecture), Kiyomi Kakiuchi (Nara Institute of Science and Technology)

**P8** Flow Synthesis of Methanofullerene Derivative PCBM Using *in situ* Generated Sulfur Ylide

**Takatoshi Ito** (Osaka Research Institute of Industrial Science and Technology), Toshiyuki Iwai (Osaka Research Institute of Industrial Science and Technology), Shuhei Sumino (Osaka Research Institute of Industrial Science and Technology), Fukashi Matsumoto (Osaka Research Institute of Industrial Science and Technology), Yuta Inoue (Ryukoku University), Tetsuo Iwasawa (Ryukoku University), Takumi Mizuno (Osaka Research Institute of Industrial Science and Technology), Toshinobu Ohno (Osaka Research Institute of Industrial Science and Technology)

- P9** Synthesis of Diarenopentalenes: Consecutive in situ Preparation of Hydrogen Iodide and Transannulation of Sondheimer-Wong Dienes  
**Akihiro Orita** (Okayama University of Science), Yasuhiro Okuda (Okayama University of Science), Takanori Nishida (Okayama University of Science), Hirofumi Yamashita (Okayama University of Science), Takafumi Hagihara (Okayama University of Science)
- P10** Continuous-Flow Dynamic Kinetic Resolution of Racemic Secondary Allyl Alcohols Using a Single Packed-bed Reactor Containing Lipase and Oxovanadium  
Dhiman Kundu (Osaka University), **Satoko Katsuragi** (Osaka University), Shigeaki Masuda (Osaka University), Shuji Akai (Osaka University)
- P11** Facile Procedure for Iron Catalyzed Cross-Coupling Reaction by a Microreactor  
**Koji Machitani** (Industrial Technology Center of Wakayama Prefecture), Hajime Mori (Industrial Technology Center of Wakayama Prefecture), Yasuhiro Nishiyama (Industrial Technology Center of Wakayama Prefecture), Akane Saito (Industrial Technology Center of Wakayama Prefecture), Yoshie Tanaka (Wakayama Medical University)
- P12** Development of Flow Microwave Reactors with Solid State Microwave Source and Their Application to High Speed Synthesis of Valuable Functional Materials  
**Takeko Matsumura** (Minerva Light Laboratory LLC.), Kazunori Yamashita (Minerva Light Laboratory LLC.), Atsushi Nakagawa (Finchems Inc. HQ plant and R&D)
- P13** Microflow Synthesis and Organic Semiconductor Characteristics of Alkyltetrathienonaphthalene  
**Hiroshi Ikeda** (Osaka Prefecture University), Atsushi Yamamoto (Osaka Prefecture University), Yasunori Matsui (Osaka Prefecture University), Toshio Asada (Osaka Prefecture University), Motoki Kumeda (Osaka Prefecture University), Kimiya Taniguchi (Osaka Prefecture University), Kenichiro Takagi (Osaka Prefecture University), Yu Suenaga (Osaka Prefecture University), Kunihiro Nagae (Osaka Prefecture University), Eisuke Ohta (Osaka Prefecture University), Hiroyasu Sato (Rigaku), Shiro Koseki (Osaka Prefecture University), Hiroyoshi Naito (Osaka Prefecture University)
- P14** Green synthesis of  $\alpha$ -amino acids by electrochemical carboxylation in a flow microreactor  
**Yang Qu** (Yokohama National University), Chiaki Tsuneishi (Yokohama National University), Hiroyuki Tateno (Yokohama National University), Yoshimasa Matsumura (Yamagata University), Mahito Atobe (Yokohama National University)
- P15** Stereoselective Electrochemical Synthesis of *Z*-Alkenes from Alkynes Using a PEM Reactor  
**Juri Minoshima** (Yokohama National University), Atsushi Fukazawa (Yokohama National University), Mahito Atobe (Yokohama National University), Yasushi Hashimoto (JXTG Nippon Oil & Energy Co.), Yoshihiro Kobori (JXTG Nippon Oil & Energy Co.), Yasushi Sato (JXTG Nippon Oil & Energy Co.)
- P16** Axis-to-Center Chirality Transfer for the Synthesis of *P*-Stereogenic Organophosphorus Compounds  
**Aya Sugiyama** (Gifu University), Kazuma Kuwabara (Gifu University), Toshiaki Murai (Gifu University)



- P17** Efficient Glycosylations Using Micro Fluidic System  
**Seiji Masui** (Osaka University), Yoshiyuki Manabe (Osaka University), Kento Tokunaga (Osaka University), Sianturi Julinton (Osaka University), Atsushi Shimoyama (Osaka University), Takahide Fukuyama (Osaka Prefecture University), Ilhyong Ryu (Osaka Prefecture University), Koichi Fukase (Osaka University)
- P18** Generation and Reactions of 2,2,2-Trifluoro-1-(phenylsulfonyl)ethyl Anion  
**Ryosuke Arai** (Gunma University), Hiroyuki Murata (Gunma University), Aiichiro Nagaki (Kyoto University), Jun-ichi Yoshida (Kyoto University), Hideki Amii (Gunma University)
- P19** Regio- and Stereoselective Carbozincation of Alkynyl Ethers Using Metal Halides and Silyl Enolates  
**Kyoungmin Kang** (Osaka University), Kosuke Sakamoto (Osaka University), Yoshihiro Nishimoto (Osaka University), Makoto Yasuda (Osaka University)
- P20** Cyclopentene Annulation by Flow Process  
**Daisuke Domon** (Hokkaido University), Aiichiro Nagaki (Kyoto University), Jun-ichi Yoshida (Kyoto University), Keiji Tanino (Hokkaido University)
- P21** Deprotonation of Dibromothiophenes Controlled by Flash Chemistry  
**Kentaro Okano** (Kobe University), Yoshiki Yamane (Kobe University), Rikako Tada (Kobe University), Aiichiro Nagaki (Kyoto University), Jun-ichi Yoshida (Kyoto University), Atsunori Mori (Kobe University)
- P22** Scalable Flow Synthesis of PCBM using a Flow Photo-Reactor with a Na Lamp  
**Mitsuhiro Ueda** (Osaka Prefecture University), Naoyuki Imai (Showa Denko K.K), Shunsuke Yoshida (Showa Denko K.K), Hiroshi Yasuda (Showa Denko K.K), Takahide Fukuyama (Osaka Prefecture University), Ilhyong Ryu (Osaka Prefecture University)
- P23** Photoinduced Chemoselective Coupling Reaction of  $\alpha$ -Bromo Ketones with Silyl Enol Ether Catalyzed by an Organic Dye  
Esumi Naoto (Osaka University), **Kensuke Suzuki** (Osaka University), Yoshihiro Nishimoto (Osaka University), Makoto Yasuda (Osaka University)
- P24** Three-step Sequential Continuous-flow Synthesis of *rac*-Pregabalin  
**Haruro Ishitani** (The University of Tokyo), Kan Kanai (The University of Tokyo), Shu Kobayashi (The University of Tokyo)
- P25** Miniature in-Line Chiral Analyzer Based on Polarization-analyzing CMOS Image Sensor  
**Takashi Tokuda** (Nara Institute of Science and Technology), Yasuto Mori (Nara Institute of Science and Technology), Makito Haruta (Nara Institute of Science and Technology), Toshihiko Noda (Nara Institute of Science and Technology), Kiyotaka Sasagawa (Nara Institute of Science and Technology), Momoe Nakano (Nara Institute of Science and Technology), Yasuhiro Nishiyama (Nara Institute of Science and Technology), Tsumoru Morimoto (Nara Institute of Science and Technology), Kiyomi Kakiuchi (Nara Institute of Science and Technology), Jun Ohta (Nara Institute of Science and Technology)
- P26** Generation and Synthetic Applications of Trifluoromethyl Isobenzofurans  
Shun Shinada (Gunma University), Masanori Inaba (Gunma University), Yoshimasa Hikobe (Gunma University), **Hideki Amii** (Gunma University), Yuta Nishina (Okayama University)

- P27** Synthesis of  $\alpha$ -Alkylidene- $\beta$ -Oxoimide using Flow System  
Katuhiro Komuro (Waseda University), **Hiroki Shimoda** (Waseda University), Masahiro Uwamori (Waseda University), Aiichiro Nagaki (Kyoto University), Jun-ichi Yoshida (Kyoto University), Masahisa Nakada (Waseda University)
- P28** Catalytic Enantioselective Sequential C-C Bond Forming Reactions in Flow System  
**H.D.P. Wathsala** (ISIR, Osaka University), Kenta Kishi (ISIR, Osaka University), Chen Qingwen (ISIR, Osaka University), Shinobu Takizawa (ISIR, Osaka University), Hiroaki Sasai (ISIR, Osaka University)
- P29** [2+2] Cycloadditions of 1,3-Bifunctional Allenes with C<sub>60</sub> by using a Flow Reaction System  
**Hiroyuki Hashishita** (Osaka Prefecture University), Miho Hayama (Osaka Prefecture University), Aiko Munechika (Osaka Prefecture University), Mitsuhiro Ueda (Osaka Prefecture University), Takahide Fukuyama (Osaka Prefecture University), Ilhyong Ryu (Osaka Prefecture University)
- P30** Microflow Systems for the Organic Reactions Promoted by a Catalytic Amount of Electricity  
**Seiji Suga** (Okayama University), Hiroki Tanaka (Okayama University), Yuusuke Kurihara, (Okayama University), Takayuki Hirata (Okayama University), Koichi Mitsudo (Okayama University)
- P31** Synthetic Study of Dragmacidins via Decarboxylative Alkynylation Using Visible-Light-Mediated Photoredox Catalysis in a Flow System  
**Shota Kawakami** (Keio University), Yohei Arai (Keio University), Zenyu Shiokawa (Keio University), Takanori Matsumaru (Keio University), Shinsuke Inuki (Keio University, Kyoto University), Yukari Fujimoto (Keio University)
- P32** Synthesis of Donor-Acceptor-Substituted Dye Having a Directing Group for Photoelectric Conversion  
Yasuhiro Okuda (Okayama University of Science), **Takafumi Hagihara** (Okayama University of Science), Takehiro Morimoto (Okayama University of Science), Akihiro Orita (Okayama University of Science)
- P33** Magnetic Attachment of Lipase Immobilized on Bacteriogenic Iron Oxide Inside a Microtube reactor for the Kinetic Resolution of Secondary Alcohols  
**Kyoko Mandai** (Okayama University), Takehiro Fukuda (Okayama University), Miyazaki Yuki (Okayama University), Hideki Hashimoto (Okayama University), Hiroki Mandai (Okayama University), Tadashi Ema (Okayama University), Jun Takada (Okayama University, CREST JST), Seiji Suga (Okayama University)
- P34** Novel Protocol for Chemoselective HalogenMetal Exchange on Cubane Using Dianion-type Zincate, R<sub>4</sub>ZnLi<sub>2</sub>  
**Yumi Kato** (Kyoto University), Seiji Matsubara (Kyoto University)
- P35** Efficient Synthesis of  $\alpha$ -Gal Using One-Pot and Microfluidic Approaches for Development of a Novel Cancer Immunotherapy  
**Julinton Sianturi** (Osaka University), Yoshiyuki Manabe (Osaka University), Kazuya Kabayama (Osaka University), Koichi Fukase (Osaka University)

- P36** Flow Amination of Functional Organolithiums: Design and Preparation of Aminating Reagents Using Benchtop Stopped-Flow NMR  
**Yuya Yonekura** (Kyoto University), Heejin Kim (Kyoto University), Jun-ichi Yoshida (Kyoto University)
- P37** Selective Mono Addition of Aryllithiums to Dialdehydes by Micromixing  
**Hiroki Yamashita** (Kyoto University), Yusuke Takahashi (Kyoto University), Satoshi Ishiuchi, (Kyoto University) Keita Imai (Kyoto University), Aiichiro Nagaki (Kyoto University), Jun-ichi Yoshida (Kyoto University)

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**Exhibitions**

13:00~17:00, January 18<sup>th</sup>

9:00~16:00, January 19<sup>th</sup>

## **Exhibitors List**

Asahi Lab Commerce, Inc.

Blacktrace Japan Inc.

Device for FlowChemistry

DKSH Management Ltd.

Fuji Techno Industries Corporation

Junkosha Inc.

KOBE STEEL,Ltd.

MAKENGINEERING CORPORATION

M Technique Co., Ltd.

NARD Institute,Ltd.

Nippon Science Core Co.

Quality Design Co., Ltd.

SCRUM Inc.

TACMINA CORPORATION

TOKYO RIKAKIKAI CO., LTD.

YMC CO.,LTD.

TecnoApplications Co.,Ltd.



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