Kobe (2006) Seoul (2012) IWPI Series Tokyo (2008) Manchester (2016)

Fukuoka (2010) Taipei (2018)

# 6<sup>th</sup> International Symposium on Process Intensification

# 7 – 8 November 2018 Taipei

**Hosted by** 

Department of Chemical Engineering College of Engineering National Taiwan University

## Supported by

Ministry of Science and Technology of Taiwan Taiwan Institute of Chemical Engineers The Society of Chemical Engineers of Japan Kobe University, Japan Young Researcher Assoc. of the Division of Chem. Eng., SCEJ Assoc. of the Division of Fluid and Particle Processes, SCEJ Sumitomo Heavy Industries Process Equipment Co., Ltd. Yee Fong Chemical & Industrial Co., Ltd.

## 6<sup>th</sup> IWPI 2018 Technical Programs

### Wednesday 7 Nov 2018

Room 1	Room 2	Room 3
09:00-09:10		
	Opening Ceremony	
	09:10-09:55	
Process Intensific	ation for Membrane Assist	ed Crystallization
	(Enrico Drioli)	
	09:55-10:20	
Tea Break		
10:20-12:00	10:20-12:00	10:20-12:00
D11R1	D11R2	D11R3
12:00-13:30		
Lunch		
13:30-15:10	13:30-15:10	13:30-15:10
D12R1	D12R2	D12R3
15:10-16:15		
Poster Session 1		
16:15-17:00		
Characteristics and Industrial Applications of Polymerization Reactors		
(Ryuichi Yatomi)		
17:30-19:30		
Banquet (Living One)		

## Thursday 8 Nov 2018

Room 1	Room 2		
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Harnessing of Micro-, Meso-, and Macro-porous Materials			
in Chemical Engine	eering Applications		
(Kevin C	W. Wu)		
09:55	-10:20		
Tea E	Break		
10:20-12:00	10:20-12:00		
D21R1	D21R2		
12:00	-13:30		
Lur	nch		
13:30-15:10	13:30-15:10		
D22R1	D22R2		
15:10-16:15			
Poster Session 2			
16:15-17:00			
Application of Periodic Fluid Motion to Agglomeration of Particles			
(Woo-Sik Kim)			
17:00	17:00-17:10		
Closing			



**International Workshop on Process Intensification** 

IWPI Series : Kobe (2006) Tokyo (2008) Fukuoka (2010)

ul (2012) Manchester (2016)

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## **Distinguished Keynote Speakers**

Enrico Drioli	IT	Institute on membrane Technology (IMT-NCR)	e.drioli@itm.cnr.it
Ryuichi Yatomia	JP	Sumitomo Heavy Industries Process Equipment	ryuichi.yatomi@shi-g.com
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#### http://IWPI2018.org

On behalf of the International Program Committee of the 6th International Workshop on Process Intensification (IWPI 2018) to be held in Taipei, Taiwan, I would like to give a hearty welcome to all the participants and accompanying persons to IWPI 2018. The IWPI 2018 will consist of four keynote lectures by celebrated scientists, 20 invited talks by talented young researches in the Young ChemE session and 81 regular presentations (31 oral and 50 poster presentations) from many countries including Taiwan, Japan, Korea and Australia. IWPI brings together the global process intensification across academia, industry and research institutions to share and discuss the most recent developments in research and in processing. This workshop is also unique in its Young ChemE session organized by promising young researches.

The International Program committee would like to express our sincere gratitude to Prof. Cheng-Liang Chen and all organizers of the IWPI and those who have worked hard to make this workshop success. We would like to greatly appreciate great supports by TwIChE, SCEJ, National Taiwan University, Kobe University and Sumitomo Heavy Industries Process Equipment Co., Ltd. We hope that participants will be able to exchange new ideas and to obtain valuable information on process intensification through the presentations and discussions. We are sure you will thoroughly enjoy the workshop program, the associated activities and the engaging environment of IWPI 2018.

Naoto Ohmura

Naoto Ohmura Chairman of International Program Committee, IWPI 2018



Distinguished Young ChemE Researchers,

First of all, thank you for joining the Young ChemE Session at the 2018 International Workshop on Process Intensification (IWPI). This is the first time the IWPI organizes such a session for young scientists. Therefore, on behalf of the organizing committee, it is our great honor to invite you to participate in this exciting scientific event in which recent advances of process intensification will be presented and discussed with diverse portfolios.

In the Young ChemE Session, there are 20 invited talks from several different countries including Taiwan, Japan, Korea, Thailand, Singapore, China, England, and so on. We specifically select talented young scientists to present their newest research results in this session, which will definitely motivate intellectual challenges among participants, so that everyone will have the opportunity to foster new ideas. We aim to help young scientists communicate with each other, make good friends with each other, and keep this friendship with each other in the future.

Taiwan, Asia's leading chemical engineering research hub, welcomes you to enjoy what will be an excellent workshop and to enjoy much more that Taiwan has to offer – state-of-the-art infrastructure, a unique blend of a contemporary and traditional way of life as well as its multi-cultural heritage. The Organizing Committee vows to put our greatest efforts towards creating this momentous event. With open arms and warm regards, we look forward to your participation on and welcome you to Young ChemE Session with a very special and rewarding journey.

Session Organizer

papum

Takafumi Horie Kobe University Japan

'dy

Dun-Yen Kang National Taiwan University Taiwan

Jeong Woo Han Pohang University of Science and Technology Korea



#### **NOC Welcomes You to Taipei**

On behalf of the National Organizing Committee (NOC) for **IWPI 2018**, it is a pleasure to welcome all of you to Taipei. It is also a great honor that the Department of Chemical Engineering at National Taiwan University (NTU) can host this conference.

Taipei is the largest city in Taiwan with 2.6 million people living within the city and more than six million living in the greater metropolitan area. Popular attractions in Taipei include the National Palace Museum, which boasts a collection of nearly 700,000 imperial artifacts and artworks spanning nearly 8,000 years of Chinese history; Taipei 101, the tallest skyscraper in Taiwan and once the tallest building in the world, etc.

NTU can trace its origins to the late 19<sup>th</sup> century, when Taiwan Hospital was established. The University comprises eleven colleges, three professional schools, 54 departments, 109 graduate institutes and 66 research centers. There are 32,000 students enrolled, with an equal number of undergraduate and graduate students. The total land size of NTU is 1% of Taiwan. The Chemical Engineering Department at NTU was founded in 1941 as the first such department in Taiwan. We typically have 36 full-time faculty, 500 undergraduate students, 200 master's students and 70 PhD candidates studying at any given time.

In the 6<sup>th</sup> IWPI 2018, we have a very full program planned for two days. We sincerely hope that you appreciate these technical sessions. Again thank you for coming and we hope you enjoy your time in Taiwan.

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Cheng-Liang Chen IWPI 2018 NOC Chair Department of Chemical Engineering National Taiwan University <u>CCL@ntu.edu.tw</u>

#### **Process Intensification for Membrane Assisted Crystallization**

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#### Abstract

An important contribution to the realization of the industrial sustainable development can be given by Process Intensification (PI) strategy. The latter is based on innovative equipment, design and process development methods that are expected to bring substantial improvements in chemical and any other manufacturing and processing aspects, such as decreasing production costs, equipment size, energy consumption, waste generation, and improving remote control, information fluxes and process flexibility.

Membrane technology and membrane engineering hold a crucial role for the implementation of this strategy. The growth of membrane engineering has been significant in the last few years and various large unit operations of process engineering have been already redesigned as a membrane unit. With their intrinsic characteristics of efficiency and operational simplicity, high selectivity and permeability for the transport of specific components, compatibility between different membrane operations in integrated systems, low energetic requirement, good stability under operating conditions and environment compatibility, easy control and scale-up, and large operational flexibility, membrane operations represent an interesting answer for the rationalization of chemical productions. Membrane distillation (MD), membrane assisted crystallization (MCr) and various other membrane contactor (MC) operations, in their various configurations and functionalities, are growing in parallel to the molecular separations realized with pressure driven membrane operations. In particular, recently, membrane assisted crystallization (MCr) has increased in interest and more and more publications can be found in literature. MCr is an innovative technology combining membrane operations and crystallization with some important advantages with respect to traditional crystallization processes: well-controlled nucleation and growth kinetics, fast crystallization rates and reduced induction time, membrane surface promoting heterogeneous nucleation and control of supersaturation level and rate. Moreover, in the logic of the realization of improved productive cycles inspired to the Process Intensification strategy, an important field where MCr technology is expected to give a fundamental contribution is seawater desalination, which is becoming the most economically competitive way to resolve the potable water demand in regions with high deficiencies. In this field MCr is emerging as promising technique to improve desalination system, contributing to the enhancement of water recovery factor together with metals recovery from brine streams of these plants. With respect to RO process, MCr does not suffer significant limitations due to the osmotic pressure of highly concentrated brines and can be therefore employed when high permeate recovery factors or brine recovery is requested.

The possibility to utilize seawater and brackish waters not only as source of fresh water but also for the production of metals of interest can be considered an interesting possibility. The large amount of brine produced all round the world by large scale RO operations might be an interesting resource, in some cases alternative to the traditional mines. The high quality of the crystals obtained through MCr, the possibility to increase the kinetic of crystal growth, and the possibility to produce specific polymorphs, etc. might create new production systems for various metals present in the desalination retentate streams, minimising the brine disposal problem.

Moreover, interesting opportunities exist in the crystallization of both small organic molecules of interest, for example, in pharmaceutics, and large bio-macromolecules (like proteins). Furthermore, an undoubted benefit of this novel technology, with respect to other traditional comparable techniques, is the ability to speed up crystallization kinetics even for high-molecular weight macromolecules, like proteins, which are characterized by low diffusivity in solution. The porous topography of the membrane surface and the existence of chemical functionalities in the polymer chain act together as promoter of heterogeneous nucleation at supersaturation levels that would not be adequate for spontaneous nucleation in the bulk of the solution.

These aspects, all combined in a unique technology, make MCr of potential interest with respect to the needs of 'facilitated' and 'controlled' crystallization, enhancing process efficiency and reduced environmental impact, according to a PI strategy.

#### **Relevant bibliography:**

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#### **Characteristics and Industrial Applications of Polymerization Reactors**

#### Ryuichi Yatomi<sup>a</sup>

#### <sup>a</sup> Sumitomo Heavy Industries Process Equipment, Japan <u>ryuichi.yatomi@shi-g.com</u>

#### Abstract

The aim of my presentation is to describe the industrial applications of process intensification in polymerization reactors. In industry, lots of special reactors with unique concept (for example fluidized bed gas-phase reactor, loop reactor, horizontal reactor etc. as shown in Fig.1) had been developed in order to solve the problem caused by "reaction heat" and "high viscosity" in polymerization process. However conventional "mixing reactor" is still commonly used and its occupancy is more than 75 % in industrial operation. So that mixing reactor is focused on this paper.

The method of our process intensification is by using the new mixing impeller that we have developed and named Maxblend<sup>®</sup>, its advantages are reported regarding the functions of uniform mixing, heat transfer, gas absorption, solid suspension etc., as shown in Fig. 2. Adding, QFD (Quality Function Development) is one of the useful method to understand the process requirement before we try to approach the "process intensification". In conclusion, improvement results by Maxblend<sup>®</sup> in typical polymerizations are itemized as follows;

#### 1. Solution Polymerization (Fig. 3)

- a) Key Function: Uniform Mixing at High Viscosity Fluid
- b) Problem : Cleaning interval every 1 weeks, because of Serious Adhesion
- c) Improvement: Cleaning interval once per 6 month, because Adhesion Decreased

#### 2. **Emulsion Polymerization** (Fig. 4)

- a) Key Function: Uniform Mixing with Minimum Shear to Prevent Micelle Breakage
- b) Problem : Adhesion 2600 kg per batch
- c) Improvement: Adhesion 700 kg per batch

#### 3. Suspension Polymerization (Fig. 5)

- a) Key Function: Uniform Suspension without Particle Breakage (=Lower Shear)
- b) Problem : Particle distribution is "Broad" (Breakage around 70 %)
- c) Improvement: Particle distribution is "Sharp" (Breakage around 30%)

#### 4. **Hydrogenation** (Fig. 6)

- a) Key Function: H<sub>2</sub> gas absorption by Surface Aeration (=gas suction from head space)
- b) Problem : Conversion 98.5 % (Still remaining 1.5 %)
- c) Improvement: Conversion 99.98 % (remaining only 0.02 %)

Keywords; Polymerization; Reactor; Industrial; Improvement; Maxblend



Figure 1. Polymerization Reactors



Figure 3. Solution Polymerization



Figure 2. Advantage of Maxblend



Figure 4. Emulsion Polymerization



Figure 5. Suspension Polymerization



Figure 6. Hydrogenation

### References

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#### Harnessing of Micro-, Meso-, and Macroporous Materials in Chemical Engineering Applications

Kevin C.-W. Wu

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#### Abstract

Nanoporous materials can be classified into three categories according to their pore size: microporous (or metal-organic frameworks (MOFs) in this study) (< 2 nm), mesoporous (2 – 50 nm), and macroporous (> 50 nm). These nanoporous materials exhibit high surface areas, controllable morphology (nanoparticle and thin films), and tunable surface functionalities (amino group, thiol group, carboxylic group; therefore, they have been showing great potential in many chemical engineering fields. In this talk, I will focus on the synthesis of novel nanoporous materials (the composition includes silica, metal oxides, and carbon) for solving energy and environmental issues including membrane separation, biofuel generation, and capacitive deionization (CDI).

For membrane separation, despite much progress in the development of mixed matrix membranes (MMMs) for many advanced applications, there is still a challenge to synthesize MMMs without particle agglomeration or phase separation at high loadings of nano-fillers. Here, we solve this problem by synthesizing nanoporous zeolitic imidazole framework (ZIF-8) nanoparticles with a particle size of 60 nm and a pore size of 0.38 nm in water phase and directly incorporating them into an organic polymer (poly(vinyl alcohol; PVA)) aqueous solution without a drying process, leading to a high-quality ZIF-8/PVA MMM with enhanced

performances in ethanol dehydration via pervaporation. The permeability is 3 times as much as that of pristine PVA and the separation factor is nearly 9 times as much as that of the pristine PVA. The significant enhancements in separation performances are attributed to the rises in fractional free volume in membranes which are analyzed by positron annihilation lifetime spectroscopy.



For biomass conversion, we have synthesized a new metal-free and nitrogen-containing nanoporous carbon with controllable amounts of nitrogen configuration through a simple pyrolysis of ZIF-8 nanoparticles. Unlike conventional nitrogen-doped carbon materials with low nitrogen-loading density, the ZIF-8 derived nanoporous nitrogen-doped carbon (NNC) enhances the loading amount of nitrogen, especially for the formation of graphitic nitrogen (N-

Q) after calcination at 900 °C. The increased N-Q structure in the NNC-900 catalyst was found to be useful for catalyzing aerobic oxidation of HMF to FDCA with a



maximum yield of 80% at 80 °C and ambient pressure. The pathway of HMF-to-FDCA conversion is also estimated, where HMFCA and FFCA are the main intermediates. The presenting green, economical and effective heterogeneous NNC catalyst would have much potential in not only biomass conversion but also other oxidation-involved organic reactions.

For CDI application, we describe an approach to assemble hierarchically-ordered 3D arrangements of curved graphenic nanofragments for energy storage devices. Assembling them into well-defined interconnected macroporous networks, followed by removal of the template, results in spherical carbon microball (3MCM) architectures with controllable features spanning nanometer to micrometer length scales. These structures are ideal porous electrodes and can serve as lithium ion battery (LIB) anodes as well as capacitive deionization (CDI) devices. The

LIBs exhibited high reversible capacity (up to 1335 mAh/g), with great rate capability (248 mAh/g at 20 C) and a long cycle life (60 cycles). For CDI the curved graphenic networks have superior electrosorption capacity (i.e. 5.17 mg g<sup>-1</sup> in 0.5 mM NaCl) over conventional carbon materials. The performance of these materials is attributed to the hierarchical structure of the graphenic electrode, which enables faster ion diffusion and low transport resistance.



**Keywords:** Microporous materials (metal-organic frameworks); mesoporous materials; macroporous materials; pervaporation; capacitive deionization (CDI).

#### **References:**

*Energy & Environmental Science*. 2014, 7 (11), 3574–3592. *Journal of the American Chemical Society*. 2015, 137(13), 4276-4279. *Angewandte Chemie International Edition*. 2016, 55, 12793-12796. *Green Chemistry*. 2016, 18, 5957-5961. *Advanced Materials*. 2017, 29, 1700213. *Angewandte Chemie International Edition*. 2018, 57(11), 2894-2898. Very Important Paper.



#### **Application of Periodic Fluid Motion to Agglomeration of Particles**

#### Woo-Sik Kim<sup>a</sup>

#### <sup>a</sup> Functional Crystallization Center, Department of Chemical Engineering Kyung Hee University, Kyungki-do 17104 Korea wskim@khu.ac.kr

#### Abstract

Agglomeration is one of key phemomena in crystallization for powder synthesis and solidliquid separation. However, it is ambivalent in practical process. That is, the agglomeration is essential for synthesis of large particles beneficial to solid-liqid separation, whereas it is harmful to purification due to inclusion of mothor liquid in the agglomerate.

In the barrtey inductry, (Ni/Mn/Co) oxide is most promising material for cathode of high electric capacity and charge/discharge performance. Regarding to the electric capacity, the morphology of (Ni/Mn/Co) oxide is critical in detetermination of its packing density of cathode in fixed volume of battery. Thus, the spherical agglomerate of (Ni/Mn/Co) oxide is highly desired for cathode in industry. Since the (Ni/Mn/Co) oxide is synthesized via a solid-state thermal decomposition of (Ni/Mn/Co) hydroxide, the morphology of (Ni/Mn/Co) oxide is mostly predetermined by the agglomeration of (Ni/Mn/Co) hydroxide during the crystallization. (Ni/Mn/Co) hydroxide was precipitated by the reaction of (Ni/Mn/Co) sulfate and NaOH. Actually, the reaction produces the hexagonal nano-plate particles. So, agglomeration of the particle is necessary for production of large and spherical agglomerates which are good for effective powder handling, solid-liquid separation of (Ni/Mn/Co) hydroxide in periodic fluid fields such as Taylor vortex flow and Batchelor flow.

The Taylor vortex flow was induced in a gap between two coaxial cylinders by the rotation of inner cylinder of the crystallizer (called Taylor crystallizer).[1, 2] Due to the periodic toroidal fluid motion, the fluid shear and velicity field in whole region of gap was unform, contributing on effective collision and aggration of particles in the fluid field. So, spherical agglomerates of (Ni/Mn/Co) hydroxide were proced, of which the tap density was over 2.0 g/cm<sup>3</sup>, in a continuous operation of Taylor crystallizer. In this continuous operation, the mean resedence time was 1 hr, which was much shorter than any operation time in previous studies running in mixing tank crystallizers at batch or continuous operations. The tap desity and size of aggmoerates was varied with roation speed of inner cylinder. [1]



Figure 1. (a) Taylor vortex flow in Taylor crystallizer, (b) agglomerates of (Ni/Mn/Co) hydroxide at various rotation speed of crystallizer.[1]

Also, the agglomerate size distribution was narrower with the rotation speed of inner cylinder, enhacing the tap density of agglomerates.

When applying the Batchelor flow, which was induced between two concentric disks of crystallizer (called Batchelor crystallizer), the agglomeration of (Ni/Mn/Co) hydroxide was much promoted. So, it was achieved to produce the uniform and spherical agglomerates of (Ni/Mn/Co) hydroxde, of which the tap density was over 2.0 g/cm<sup>3</sup>, in a continuous operation of the Batchelor crystallizer. So, it could be conferred that the periodc fluid motion was highly effective for the agglomeration of particles and 10 ~20 times more productive than the random turbulent eddy fluid motion.



Figure 2. (a) Batchlor flow in Batchelor crystallizer, (b) agglomerates of (Ni/Mn/Co) hydroxide at various rotation speed of crystallizer.

- **Key words**: Periodic fluid motion; Taylor vortex flow, Batchelor flow, agglomeration, agglomerate size distribution, tap density
- Acknowledgement: This work was supported by the Engineering Research Center of the Excellence Program of National Research Foundation of Korea (NRF) (Grant NRF-2014R1A5A1009799)

#### References

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- 2. Kim J.-E. and Kim W.-S. Synthesis of Core-Shell Particles of NMC Hydroxides in Continuous Couette-Taylor Crystallizer, *Cryst. Growth Des.*, **17**, 3677–3686, 2017.

## 6<sup>th</sup> IWPI 2018 **Content List**

## Wednesday 7 November 2018

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Enrico Drioli	University of Calabria, Italy
Coffee Break	09:55-10:20
D11R1 Young ChemE Researchers	10:20-12:00
Chair: Aya Kaide	Yamaguchi University
Co-Chair: Ling Chao	National Taiwan University
10:20-10:40	
Continuous Process Development for Process Intensification U	sing the Concepts of Oscillatory
Baffled Reactors	
Takatumi Horie	Kobe University
Kana Amano	Kobe University
Naoya Numata	Kobe University
Naoto Onmura	Kobe University
	Newcastie University
10.40-11.00 Enhanced Productivity of Very High Cravity Ethanol Ferment	ation from Erash Cassaya Boot Using
Multiple Feeding Strategy	ulion from Fresh Cassava Kool Osing
Chularat Sakdaronnarong	Mahidol University
Sakchai Kurujitkosol	Mahidol University
Kanoknorn Triwitayakorn	Mahidol University
Sunaiit Sranhet	Mahidol University
Woranart Ionglertiunya	Mahidol University
11:00-11:20	intainaor emitersity
Flow Control in a Microchannel – Elastic Instability of Visc	oelastic Fluids and Flow Focusing to
Produce Soft Materials	
Ruri Hidema	Kobe University
Hiroshi Suzuki	Kobe University
11:20-11:40	<u> </u>
An Emerging Thermo-Electric Power Generator	
S. Sridhara	Northumbria University at Newcastle
R. Bhagat	University of Cambridge
C. Yang	Chinese Academy of Sciences
Y. Li	Northumbria University at Newcastle
G. McHale	Northumbria University at Newcastle
S. Wang	Newcastle University
B. Xu	Northumbria University at Newcastle

Microporous Metal Oxides: Alternative Materials for Energy Storage Watchareeya Kaveevivitchai

B. Xu 11:40-12:00

National Cheng Kung University

D11R2 Regular Oral Session	10:20-12:00
Chair: Woo Sik Kim	Kyung Hee University
Co-Chair: Enrico Drioli	University of Calabria
10:20-10:40	
Case Studies for Intensification of Pharmaceutical	Crystallization Process Using Supercritical Fluid
and Power Ultrasound	
Chie-Shaan Su	National Taipei University of Technology
10:40-11:00	
Round Granules of Dimethyl Fumarate by Three-in	-One Intensified Process of Reaction,
Crystallization, and Spherical Agglomeration in a G	Common Stirred Tank
Chih-Wei Chen	National Central University
Tu Lee	National Central University
11:00-11:20	
Intensified Crystallization Processes for 1:1 Drug-	Drug Cocrystals of Sulfathiazole–Theophylline,
and Sulfathiazole–Sulfanilamide	
Kuan-Lin Yeh	National Central University
Tu Lee	National Central University
11:20-11:40	
A Fully Integrated Centrifugal Microfluidic Platfor	ms for Point-of-Care Molecular Diagnostics
Tae Seok Seo	Kyung Hee University
11:40-12:00	
Modeling of a Batch Eutectic Freeze Crystallization	n Process
Che-An Lee	National Taiwan University
Jeffrey D. Ward	National Taiwan University

D11R3 Regular Oral Session	n 10:20-12:00
Chair: Satoru Nishiyama	Kobe University
Co-Chair: Ryuichi Yatomi	Sumitomo Heavy Industries Process Equipment
10:20-10:40	
A Novel Approach for Process Design V	When Some or All Experimental Thermodynamic Data are
Missing	
Chang-Che Tsai	National Taiwan University
Shiang-Tai Lin	National Taiwan University
10:40-11:00	
Intensification of two dimensional lamin	nar mixing using a rotationally reciprocating anchor impeller
Yoshiyuki Komoda	Kobe University
Tomoya Date	Kobe University
Ruri Hidema	Kobe University
Hiroshi Suzuki	Kobe University
Naoto Ohmura	Kobe University
11:00-11:20	
Analysis of the 3D virtual structure men	nbrane by Computer-aided engineering
Tong Yang Hsu	National Taiwan University
Pei Chuan Chen	National Taiwan University
Kuo Lun Tung	National Taiwan University
11:20-11:40	
Kinetic study of CuCl <sub>2</sub> -KCl/Al <sub>2</sub> O <sub>3</sub> cataly	vst for ethylene-oxychlorination deactivated in commercial
scale plant	
Tomokazu Ohashi	Functional polymers research laboratory, Tosoh Corporation
Sae Someya	Functional polymers research laboratory, Tosoh Corporation
Yoshihiko Mori	Functional polymers research laboratory, Tosoh Corporation
Tetsuo Asakawa	Functional polymers research laboratory, Tosoh Corporation
Makoto Hanaya	Functional polymers research laboratory, Tosoh Corporation
Motohiro Oguri	Functional polymers research laboratory, Tosoh Corporation
Ryo Watanabe	Shizuoka University
Choji Fukuhara	Shizuoka University

#### 11:40-12:00

Deactivation factor analyzed by XANES in CuCl<sub>2</sub>-KCl/Al<sub>2</sub>O<sub>3</sub> for process intensification of commercial ethylene oxychlorination plant

Sae Someya	Functional polymers research laboratory, Tosoh Corporation
Tomokazu Ohashi	Functional polymers research laboratory, Tosoh Corporation
Yoshihiko Mori	Functional polymers research laboratory, Tosoh Corporation
Tetsuo Asakawa	Functional polymers research laboratory, Tosoh Corporation
Makoto Hanaya	Functional polymers research laboratory, Tosoh Corporation
Motohiro Oguri	Functional polymers research laboratory, Tosoh Corporation
Ryo Watanabe	Shizuoka University
Choji Fukuhara	Shizuoka University

#### Lunch

#### 12:00-13:30

D12R1 Young ChemE Researchers	13:30-15:10
Chair: Keizo Nakagawa	Kobe University
Co-Chair: Dun-Yen Kang	National Taiwan University
13:30-13:50	
Solution-Processed Organic Semiconductors for High Pe	erformance Organic Field Effect Transistors
Application	
Cheng-Liang Liu	National Central University
13:50-14:10	
Novel dehydrogenation process for olefin production by	sulfide redox of transition metal-based
catalyst	
Ryo Watanabe	Shizuoka University
Nozomu Hirata	Shizuoka University
Choji Fukuhara	Shizuoka University
14:10-14:30	
Smart Textiles with Tactile Sensing	
Wen-Ya Lee	National Taipei University of Technology
14:30-14:50	
Tailoring Structural Properties of Microporous Material	ls for Advanced Gas Separations
C. Y. Chuah	Nanyang Technological University
Yanqin Yang	Nanyang Technological University
Yanqin Yang	Nanyang Technological University
Tae-Hyun Bae	Nanyang Technological University
14:50-15:10	
Enhanced Membrane Filtration Performance of Stacked	Niobate Nanosheet Membranes by The
Addition of Graphene Oxide	
Keizo Nakagawa	Kobe University
Misato Kunimatsu	Kobe University
Shintaro Araya	Kobe University
Tomohisa Yoshioka	Kobe University
Takuji Shintani	Kobe University
Eiji Kamio	Kobe University
Hideto Matsuyama	Kobe University

D12R2 Regular Oral Session	13:30-15:10
Chair: Ryo Watanabe	Shizuoka University
Co-Chair: Kevin C.W. Wu	National Taiwan University
13:30-13:50	
Effect of Catalytic Activity on the Performance of Dry Reforming	
of Methane Using Hydrogen-permeable Membrane Reactor	
Shigeyuki Uemiya	Gifu University
Akira Hamajima	Gifu University
Yoshiki Takayanagi	Gifu University
Soichiro Kato	Gifu University
Manabu Miyamoto	Gifu University
Yasunori Oumi	Gifu University
13:50-14:10	
Effect of Sn <sub>x</sub> Pt <sub>y</sub> alloy phase in SnPt bimetallic nanoparticle catalyst	s on catalytic activity for
hydrogenation of acetic acid	
Keita Taniya	Kobe University
Hiromu Takado	Kobe University
Takafumi Horie	Kobe University
Yuichi Ichihashi	Kobe University
Satoru Nishiyama	Kobe University
14:10-14:30	
ZIF-8 Derived N-doped Nanoporous Carbon for Furfural-maleic A	cid Conversion under Liquid
Oxidant	
Jing Rou Boo	National Taiwan University
Kevin CW. Wu	National Taiwan University
14:30-14:50	
Decomposition of Water over Orgamic Semiconductor Photocayaly	vst
Shota Naito	Kobe University
Atsushi Okemoto National Institute of Advanced	Industrial Science and Technology
Kensuke Kishishita	Kobe University
Keita Taniya	Kobe University
Yuichi Ichihashi	Kobe University
Satoru Nishiyama	Kobe University
14:50-15:10	
Synthesis of Propylene Glycol Monomethyl Ether Acetate (PGMEA)	) by Simulated Moving Bed
Chromatographic Reactor	
Chih-Hsiung Lin	I-Shou University
Yo-Yin Lin	I-Shou University
Ming-Tsai Liang	I-Shou University

D12R3 Regular Oral Session	13:30-15:10
Chair: Cheng Liang Chen	National Taiwan University
Co-Chair: Jeffrey D. Ward	National Taiwan University
13:30-13:50	
Design and Control of a Diphenyl Carbonat	e Reactive Distillation via Thermally Coupled
Configuration and Side Heat Exchangers	
Chien-Ying Chen	National Taiwan University of Science and Technology
Jesús Rafael Alcántara Avila	Kyoto University
Hao-Yeh Lee	National Taiwan University of Science and Technology
13:50-14:10	
Modeling by Transport Scientific Approach	for Process Intensification of Packed Column Distillation
Processes	
Kunio Kataoka	Kansai Chemical Engineering Co., Ltd
Goro Nishimura	Kansai Chemical Engineering Co., Ltd
Hideo Noda	Kansai Chemical Engineering Co., Ltd

14:10-14:30		
Reinforcement Learning Control Strategy for System with Divergent Disturbances		
Li-Ru Hsu	National Chung Hsing University	
Vincentius Surya Kurnia Adi	National Chung Hsing University	
14:30-14:50		
Generation of Ultrafine Bubbles by Ultrasonic Ir	radiation into Water Dissolving Air	
Masaki Nakamura	Graduate School of Keio University	
Koichi Terasaka	Keio University	
Satoko Fujioka	Keio University	
14:50-15:10		
A Mixed Integer Linear Programming Model for Optimal Process Intensification Retrofit		
Raymond R. Tan	De La Salle University	
Kathleen B. Aviso	De La Salle University	
Jui-Yuan Lee	National Taipei University of Technology	

Poster Session 1 (and Coffee Break)	15:10-16:15
Economic Model Predictive Control of CO <sub>2</sub> Captur	e Process Retrofitted with Membrane Units
Lester Lik Teck Chan	Chung-Yuan Christian University
Lee Yi Shan	Chung-Yuan Christian University
Junghui Chen	Chung-Yuan Christian University
Reducing Energy Cost of Absorber-Stripper CO <sub>2</sub> Co	apture Process through Economic Neural
Network Model Predictive Control	
Lee-Yi Shan	Chung-Yuan Christian University
Ooi-Sai Kit	Chung-Yuan Christian University
Dave Tanny	Chung-Yuan Christian University
Lester Lik Teck Chan	Chung-Yuan Christian University
Junghui Chen	Chung-Yuan Christian University
Absorption of $CO_2$ by Mixtures of Alkanolamine an	d Deep Eutectic Solvent in a Rotating Packed Bed
Yi-Ning Wu	Chung Yuan University
Yu-Shao Chen	Chung Yuan University
Special behavior of interface between two liquids b	y pulse microwave irradiation
Yosuke Shibata	University of Hyogo
Yusuke Asakuma	University of Hyogo
Anita Hyde	Curtin University
Chi Phan	Curtin University
Flow Reactor Design for Safer Handling of Phosge	nation Reactions
Shiori Ozasa	Kaneka Corporation
Tomoyuki Toyoda	Kaneka Corporation
Takahiro Ohishi	Kaneka Corporation
Hiroaki Yasukouchi	Kaneka Corporation
Novel Production of Liposome in a Continuous Mai	nner using Micro-Mixer and Supercritical Carbon
Dioxide	
Yuya Murakami	Tokyo Institute of Technology
Yusuke Shimoyama	Tokyo Institute of Technology
Flow Characteristics of Header With a Perforated	Plate for Flow Homogenization in Honeycomb
Hiroki Uchiyama	Fukuoka University
Takehiro Esaki	Fukuoka University
Yosuke Matsukuma	Fukuoka University
Investigation of Flow Characteristics of a Falling L	iquid Film Using Periodic Jetting Flow
Rısa Kajitani	Kobe University
Tadahiro Mukaida	Kansai Chemical Engineering Co., Ltd.
Kunio Kataoka	Kansai Chemical Engineering Co., Ltd.
Naoto Ohmura	Kobe University

Mixing performance in a Stirred Vessel for Microor	ganismim Mobilization Culture Using Biomass
Support Particles	
Yuka Mihara	Kobe University
Narges Ghobadi	Kobe University
Chiaki Ogino	Kobe University
Naoto Ohmura	Kobe University
Analysis of Effective Human Motion for Whipping H	leavy Cream by Hand toward Development of
Novel Mixing Devices	
Kazuya Ikeda	Kobe University
Takafumi Horie	Kobe University
Naoko (Kataoka) Shirasugi	Kobe University
Sachiko Honda	Kobe Yamate College
Naoto Ohmura	Kobe University
Carbon Deposition Behavior in Dry Reforming Rea	ction of Methane over Ni/Al <sub>2</sub> O <sub>3</sub> Catalysts
Ziheng Yan	Kobe University
Keita Taniya	Kobe University
Yuichi Ichihashi	Kobe University
Satoru Nishiyama	Kobe University
Particle Aggregation Process in a Chaotic Mixing H	Field
Yusuke Ochi	Kobe University
Naoto Ohmura	Kobe University
Analysis of Fluid Dynamics in An Oscillatory Baffle	d Reactor for Continuous Crystallization
Kana Amano	Kobe University
Takafumi Horie	Kobe University
Naoto Ohmura	Kobe University
Yoshihide Watabe	Asahi Glassplant
Effect of Ultrasound Irradiation on the Rate of Nand	o Exfoliative Dispersion and the Morphology of
a-ZrP	
Sayaka Higashi	Kobe University
Takafumi Horie	Kobe University
Hiroaki Sugiyama	Kaneka Corporation
Akihisa Kanda	Kaneka Corporation
Keita Taniya	Kobe University
Satoru Nishiyama	Kobe University
Naoto Ohmura	Kobe University
Investigation on Mixing Characteristics of A Micros	cale Oscillatory Baffled Reactor for Rapid
Homogeneous Reactions	
Naoya Numata	Kobe University
Takafumi Horie	Kobe University
Naoto Ohmura	Kobe University
Design of the Structured Catalyst Reactor Consider	ing Convection and Diffusion
Hiromu Sasaki	Tokyo University of Agriculture and Technology
Makoto Sakurai	Tokyo University of Agriculture and Technology
Effect of Aluminium Addition to Cu/HZSM-5 Cataly	sts on Gas-Phase Direct Synthesis of Phenol
Masaya Morimoto	Kobe University
Shun Watanabe	Kobe University
Keita Taniya	Kobe University
Yuichi Ichihashi	Kobe University
Satoru Nishiyama	Kobe University
Conversion of 5-Hydroxymethylfurfural to 1,2,6-He.	xanetriol over MOF derived Pt@Al <sub>2</sub> O <sub>3</sub>
Composites with Assistance of $NaBH_4$	
Hsiang-Ling Sung	National Taiwan University
Kevin CW. Wu	National Taiwan University
Lipid Assisted Magnesium Containing Calcium Pho	sphate as the Bone Repair Material
Yu-Hsin Chen	National Taiwan University
Kevin CW. Wu	National Taiwan University
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SOD-Embedded Metal-Organic Framework as Potential Drug Delivery Carrier for Inhibition of		
Metastatic Tumor Growth		
Hung-Lin Hsiao	National Taiwan University	
Kevin CW. Wu	National Taiwan University	
Flow and Dispersion Characteristics of Silic	ea Hard-Shell Microcapsule Slurries	
Sohei Usa	Kobe University	
Ruri Hidema	Kobe University	
Takafumi Horie	Kobe University	
Keita Taniya	Kobe University	
Yoshiyuki Komoda	Kobe University	
Yuichi Ichihashi	Kobe University	
Naoto Omura	Kobe University	
Satoru Nishiyama	Kobe University	
Hiroshi Suzuki	Kobe University	
Development and Operation of Multi-Taskin	g Silane Reactive Distillation Process for Product	
Transition		
Yu-Hong Jian	National Taiwan University of Science and Technology	
Hao-Yeh Lee	National Taiwan University of Science and Technology	
Design of Reactive Dividing-Wall Column for	or the Synthesis of Diethyl Carbonate	
Yin-Chi Wang	National Taiwan University	
I-Lung Chien	National Taiwan University	
Economical Assessment of Lignocellulose H	ydrolysis Process with Aspen Plus Simulation	
Chien-Yuan Su	Industrial Technology Research Institute	
Wei-Chun Hung	Industrial Technology Research Institute	
Jui-Yu Chang	Industrial Technology Research Institute	
Tien-San Li	Industrial Technology Research Institute	
CO <sub>2</sub> Capture based on the clathrate hydrate technology: problems and progress of SCUT		
Yan-Hong Wang	South China University of Technology	
Shuan-Shi Fan	South China University of Technology	
Xue-Mei Lang	South China University of Technology	
Qi Li	South China University of Technology	
Xiao-Jun Long	South China University of Technology	
Jing Qi	South China University of Technology	

Keynote Speech 2	16:15-17:00
Chair: Naoto Ohmura	Kobe University
Characteristics and Industrial Applications of Polyn	nerization Reactors
Ryuichi Yatomi	Sumitomo Heavy Industries Process Equipment

**Banquet** (Living One)

17:30-19:30

Thursday 8	November 2018
Keynote Speech 3	09:10-09:55
Chair: Rajarathinam Parthasarathy	RMIT University
Harnessing of Micro-, Meso-, and Macroporous A Kevin CW. Wu	Materials in Chemical Engineering Applications National Taiwan University
Coffee Break	09:55-10:20
D21R1 Young ChemE Researchers	10:20-12:00
Chair: Jeong Woo Han	Pohang University of Science and Technology
<b>Co-Chair:</b> Chung-Wei Kung	National Cheng Kung University
10:20-10:40	
Influence of Casting Solvents on Sedimentation a	nd Performance in Metal-Organic Framework
Mixed-Matrix Membranes	
Yi-Wei Chang	National Central University
Bor Kae Chang	National Central University
10:40-11:00	
Exploiting Soft Matter at Interfaces for Functiona	al Materials Production
Hyomin Lee Pohang	University of Science and Technology (POSTECH)
11:00-11:20	
Adhesion of Polymer-Functionalized Nanopartic	e to the Cell Membrane Explored Using
Generalized Langevin Dynamics	National Taiwan University
	National Talwan University
II:20-II:40	Materia Manchage on for Efficient Can Semanations
Ling Suk Lee	Mairix Memoranes for Efficient Gas Separations
Joing Suk Lee	Sogang University
Lin Woo Oh	Sogang University
11:40-12:00	Sogarg Oniversity
Polymer Electrolyte Membrane for Fuel Cell –	Insights from Mesoscale Molecular Simulation
Ming-Tsung Lee	National Taipei University of Technology
D21R2 Regular Oral session	10:20-12:00

Chair: Mitsuhiro Ohta Tokushima University Co-Chair: Hiroshi Suzuki Kobe University 10:20-10:40 Stabilization technique of magnetorheological fluids (MRF) using three kinds of additives Yamaguchi University Aya Kaide Takashi Saeki Yamaguchi University Makoto Kanda Cosmo Oil Lubricants Co., Ltd. Hiroshi Tochigi Cosmo Oil Lubricants Co., Ltd. 10:40-11:00 Numerical Simulation for Generation Mechanism of Fine Bubble by High-Speed Stirring (Effects of Initial Gas-liquid Volumetric Ratio) Yosuke Matsukuma Fukuoka University Hiroki Uchiyama Fukuoka University Takehiro Esaki Fukuoka University Katsuro Tachibana Fukuoka University Akiko Watanabe Fukuoka University 11:00-11:20 Hydrogen Microbubble Generation by Fast Dissolution of Accompanying Ammonia Gas Motoi Baba Graduate School of Keio University Koichi Terasaka Keio University

Keio University

Satoko Fujioka

11:20-11:40	
Dissolution Behavior of a Single Microbubble Accu	umulating Dissolved Gas Around Its Surface
Kanako Mizuno	Graduate School of Keio University
Satoko Fujioka	Keio University
Koichi Terasaka	Keio University
Tomoaki Shigehisa	Graduate School of Keio University
11:40-12:00	
Engineering the Viscoelasticity of Polymer Solution	n in Microfluidic Devices
Ju Min Kim	Ajou University

Lunch	

12:00-13:30

D22R1 Young ChemE Re	esearchers 13:30-15:10
Chair: Keita Taniya	Kobe University
Co-Chair: Chao-Wei Huang	National Kaohsiung Univ. of Sci and Tech
13:30-13:50	
Rational Design of Rare-Earth and	Transition Metal Doped CeO <sub>2</sub> Catalysts for Enhanced CO
Oxidation Activity	
Hyungjun Kim	University of Seoul, Pohang Univ. of Sci and Tech (POSTECH)
Kyeounghak Kim	Pohang University of Science and Technology (POSTECH)
Kyung-Jong Noh	Pohang University of Science and Technology (POSTECH)
Gunhee Lee	University of Seoul
Myeong Gon Jang	University of Seoul, Pohang Univ. of Sci and Tech (POSTECH)
Jeong Woo Han	Pohang University of Science and Technology (POSTECH)
13:50-14:10	
Catalytic Transesterification of Can	bonate Esters with Alcohols
Nai-Chieh Huang	National Taiwan University
Fang-Yi Tu	National Taiwan University
Si-Hao Chen	National Taiwan University
Guan-Huei Lee	National Taiwan University
Zi-Jie Gong	National Taiwan University
Wen-Yueh Yu	National Taiwan University
14:10-14:30	
Efficient catalytic oxidation of As(II	I) with oxygen over Pt catalysts
H. Matsune	Kyushu University
J. Zhao	Kyushu University
S. Takenaka	Kyushu University
M. Kishida	Kyushu University
14:30-14:50	
Photocatalytic Methyl Orange Deg	radation and Catalytic CO <sub>2</sub> Converstion using I-deficient BiOI
Chechia Hu	Chung Yuan Christian University
Hui-Xin Huang	Chung Yuan Christian University
Yi-Feng Lin	Chung Yuan Christian University
14:50-15:10	
Precision Engineering of Semicond	uctor Nanostructures for Next Generation Electronic Devices
Naechul Shin	Inha University

D22R2 Regular Oral session	13:30-15:10
Chair: Yosuke Matsukuma	Fukuoka University
Co-Chair: Naoto Ohmura	Kobe University
13:30-13:50	
Role of baffles in the mitigation of scale formation in ag	itated vessels
Meysam Davoody	RMIT University, CSIRO Mineral Resources
Jie Wu	CSIRO Mineral Resources
Rajarathinam Parthasarathy	RMIT University

13:50-14:10	
Process Intensification of Heat Sterilization of Foods U	Using Taylor - Couette Flow Apparatus
Hayato Masuda	University of Shizuoka, Kobe Universiy
Robert Hubacz	Warsaw University of Technology
Makoto Shimoyamada	University of Shizuoka
Naoto Ohmura	Kobe Universiy
14:10-14:30	
The Influence of Total Solids Concentration on Mixing	and Biogas Production During Batch
Anaerobic Digestion of Sewage Sludge	
James McLeod	RMIT University
Maazuza Z. Othman	RMIT University
Rajarathinam Parthasarathy	RMIT University
14:30-14:50	
Experimental Study for Local Mass Transfer Analysis	of a Packed Distillation Column
Goro Nishimura	Kansai Chemical Engineering Co., Ltd
Kunio Kataoka	Kansai Chemical Engineering Co., Ltd
Hideo Noda	Kansai Chemical Engineering Co., Ltd
Naoto Ohmura	Kobe University
14:50-15:10	
Hybrid Membrane Process for Post-combustion CO <sub>2</sub> C	Capture from Coal-fired Power Plants
Li-Xuan Ren	National Taiwan University
Dun-Yen Kang	National Taiwan University
Cheng-Liang Chen	National Taiwan University

Poster Session 2 (and Coffee Break)	15:10-16:15
Reactive Distillation and Pervaporation Process for Pro	oduction of Ethyl Lactate
Shi-Bao Dai	National Taiwan University
Hao-Yeh Lee National	Taiwan University of Science and Technology
Cheng-Liang Chen	National Taiwan University
Investigation of Energy-saving Configurations for CO <sub>2</sub>	Stripper in an Aqueous Ammonia-based
Carbon Capture Process	
Jialin Liu	Tunghai University
Design of Heat-Integrated Pressure Swing Distillation I	Processes using a Process Simulation
Automation Server	
Wei-Hsuan Lin	National Taiwan University
Xiao-Ling Yang	National Taiwan University
Jeffrey D. Ward	National Taiwan University
A study of hydrophobic ceramic membrane: Application in vacuum membrane distillation and	
membrane crystallization	
Chia-Chieh Ko	National Taiwan University
Kuo-Lun Tung	National Taiwan University
Intensifying Processes for Synthesizing Propylene Carbo	onate and Dimethylhexane-1,6-dicarbamate
by Internal Vapor Recompression	
San-Jang Wang	National Tsing Hua University
Chia-Ming Hsu	National Tsing Hua University
Yu-Ting Chen	National Tsing Hua University
Chia-Yeh Lu	National Tsing Hua University
David Shan-Hill Wong	National Tsing Hua University
Shi-Shang Jang	National Tsing Hua University
Systematic Design Strategy for Developing Water Netwo	ork under Process Uncertainty based on
Steady-State Flexibility	
Yi-Wen Wang	National Chung Hsing University
Vincentius Surya Kurnia Adi	National Chung Hsing University
On the Use of Shapley Values for Inter-Plant Water Inte	gration
Wei-Ting Liu	National Cheng Kung University
Chuei-Tin Chang	National Cheng Kung University

Optimal Design of a Hydrogenation of Benzene to Cyclohexane Process in the Presence of		
Uncertainties		
Shueh-Hen Cheng	Tunghai University	
Chi-Hao Lo	CTCI Corporation	
Wan-Ru Fang	Tunghai University	
Chi-Chang Tsai	Tunghai University	
Ta-Chen Lin	Tunghai University	
Integration of Reverse Osmosis and Pressur	e Retarded Osmosis Processes for Designing	
Stand-Alone Salinity Power Driven Desalin	ation Systems	
Jyh-Cheng Jeng	National Taipei University of Technology	
Chun-San Chen	National Taipei University of Technology	
Heng-Yi Chu	National Taipei University of Technology	
Production of Activated Carbon by modified	$LK_2CO_3$ Activation	
Jun'ichi Hayashi	Kansai University	
Isao Hasegawa	Kansai University	
Formation Mechanism of Hot Spot by Non-e	equilibrium Local Heating of Microwave Irradiation	
Shunsuke Nishijima	University of Hyogo	
Yosuke Shibata	University of Hyogo	
Yusuke Asakuma	University of Hyogo	
Recent Applications of Drag Reduction Cau	sed by Cationic Surfactant	
Takashi Saeki	Yamaguchi University	
Aya Kaide	Yamaguchi University	
Fabrication of Silica-based Catalytic Membrane including Pt Catalysts Encapsulated in Hollow		
Silica Nanotubes		
Daiki Iwasaki	Kobe Universiy	
Keizo Nakagawa	Kobe Universiy	
Takuji Shintani	Kobe Universiy	
Eiji Kamio	Kobe Universiy	
Hideto Matsuyama	Kobe Universiy	
Tomohisa Yoshioka	Kobe Universiy	
Particle Size and Crystal Habit Modification of Probenecid Using Power Ultrasound and Polymeric		
Additives in Cooling Crystallization		
Jun-Min Li	National Taipei University of Technology	
Jia-Yi Wu	National Taipei University of Technology	
Bin-Han Yang	National Taipei University of Technology	
Chie-Shaan Su	National Taipei University of Technology	
Demulsification of Oil-in-water Emulsions by An Alternative Electric Field: Droplet Size		
Distribution and Demulsification Efficiency		
Yuki Mizoguchi	Osaka Prefecture University	
Akinori Muto	Osaka Prefecture University	
CFD-DPM Prediction of Pipe Erosion in a	Staged Fluidized Bed	
Wan-Yi Hsu	Chang Gung University	
Shih-Yang Huang	Chang Gung University	
An-Ni Huang	Chang Gung University	
Hsiu-Po Kuo	Chang Gung University	
Kinetics Study of Chlorination Reaction of I	Polyvinyl Chloride focusing on Chloride Bonding Row for	
Process Intensification		
Tomoyuki Yoshimi	Kaneka Corporation	
Design and Simulation of Grade Transition	for an Industrial Polypropylene Process	
Wei-Han Cheng	Chang Gung University	
Yi-Wei Chen	Chang Gung University	
Yi-Hsun Yu	Chang Gung Memorial Hospital	
Gow-Bin Wang	Chang Gung University	
Simulation and Optimization of a Di-butyl Phthalate Production Process		
Chi-Ming Chen	National Taipei University of Technology	
Hao-Yeh Lee	National Taiwan University of Science and Technology	
Jui-Yuan Lee	National Taipei University of Technology	

Effects of Nano-Hole Size on Dynamic Characteristics of Calcium Choride/Silica Micro-Capsule		
Composites		
Iori Kanzaki	Kobe Universiy	
Hiroshi Suzuki	Kobe Universiy	
Keiko Fujioka	Functional Fluids Ltd.	
Ippei Watanabe	Kobe Universiy	
Ruri Hidema	Kobe Universiy	
Yoshiyuki Komoda	Kobe Universiy	
Kosuke Suzuki	Kobe Universiy	
Numerical Simulations of Drop Breakup in Strong Simple S	Shear Flow	
Shungo Hamada	Tokushima University	
Mitsuhiro Ohta	Tokushima University	
Mark Sussman	Florida State University	
The Effect of the Thermal Conductivity of the Heated Substrate on Bubble Growth in Nucleate		
Boiling		
Yuya Shudo	Tokushima University	
Mitsuhiro Ohta	Tokushima University	
Mark Sussman	Florida State University	
Moisture content and Carr index of dried naproxen sodium drug formulation powder		
Maha Al-Ali	RMIT University	
Selvakannan Periasamy	RMIT University	
Rajarathinam Parthasarathy	RMIT University	
Dye-sensitized Photocatalyst for Photocatalytic Splitting of Water into Hydrogen		
Yi-Shan Huang	National Taiwan University	
Yu-Chieh Pao	Industrial Technology Research Institute	
Jeffrey C. S. Wu	National Taiwan University	
Microwave Enhancement of Direct Epoxidation of Bisphenol A Diallyl Ether (BADAE) Into		
Bisphenol A DiGlycidyl Ether (BADGE)		
Yu-Han Cheng	National Tsing Hua University	
David Shan-Hill Wong	National Tsing Hua University	
En-Ko Lee	National Tsing Hua University	
Comparison of MEA Slip in Capturing Carbon Dioxide by Rotating Packed Bed and Packed Bed		
Ching-Hung Cheng	National Tsing Hua University	
Jia-Lin Kang	Tamkang University	
De-Hao Tsai	National Tsing Hua University	
David Shan-Hill Wong	National Tsing Hua University	
En-Ko Lee	National Tsing Hua University	
Shi-Shang Jang	National Tsing Hua University	

Keynote Speech 4	16:15-17:00
Chair: Da Ming Wang	National Taiwan University
Application of Periodic Fluid Motion to Agglomeration of Particles	
Woo-Sik Kim	Kyung Hee University

Closing

17:00-17:10

Dinner (Invitation Only; Howard 14F)

18:00-20:00



Taoyuan Airport to NTU (National Taiwan University)



**Map of NTU Campus** 



**Route Map of Metro Taipei** 

