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The 3rd International Workshop on Active Materials and Soft Mechatronics

# AMSM2018

October 23-26, 2018  
KAIST, Daejeon, Republic of Korea

## Programs & Abstracts

1. Soft Actuators and Sensors
2. Artificial Muscles and Electro-Active Polymers
3. Soft Robotics and Mechatronics
4. Graphene and 2D Materials
5. Functional Materials and Composites
6. Stretchable and Flexible Electronics
7. Energy Harvesting and Energy Storage Materials
8. 3D and 4D Printing
9. Space Tech (IST-NASA)



**Hosted by**  
**Korean Society for Composite Materials**  
**Korean Society of Mechanical Engineers**  
**KAIST**

## Program at a Glance

### Oct. 23, 2018

16:00-19:00	Registration (KAIST Academic Cultural Complex, 1F, E9)
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### Oct. 24, 2018

08:00-08:45	Registration (KAIST Academic Cultural Complex, 1F, E9)
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08:45-09:00	<b>Opening and Plenary Session I (Yang Seungtaik Auditorium, 2F, E9)</b>		
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09:00-09:30	Plenary Lecture 1 - Geoffrey Spinks (Univ. of Wollongong, Australia)		
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09:30-10:00	Plenary Lecture 2 - Jang-Kyo Kim (HKUST, Hong Kong)		
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10:00-10:20	Break		
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	<b>Room A</b> Yang Seungtaik Auditorium, 2F, E9	<b>Room B</b> Chung Kunmo Conference Hall, 5F, E9	<b>Room C</b> KI Fusion Hall, 1F, E4
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10:20-12:20	<b>WA1</b> Soft Actuators and Sensors I	<b>WA2</b> Stretchable and Flexible Electronics I	<b>WA3</b> Carbon Nanomaterials and Functional Composites I
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12:20-13:30	Lunch (Faculty Club, E5)		
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13:30-15:10	<b>WB1</b> Soft Actuators and Sensors II	<b>WB2</b> Soft Robotics and Mechatronics I	<b>WB3</b> Carbon Nanomaterials and Functional Composites II
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15:10-15:30	Break		
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15:30-17:10	<b>WC1</b> Soft Actuators and Sensors III	<b>WC2</b> Soft Robotics and Mechatronics II	<b>WC3</b> Carbon Nanomaterials and Functional Composites III
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17:10-17:30	Break		
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17:30-20:00	<b>Poster Session + Standing Buffet</b> (Sky Lounge Complex, 5F, E9 Academic Cultural Complex)		
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## Program at a Glance

### Oct. 25, 2018

08:00-08:30	Registration (KAIST Academic Cultural Complex, 1F, E9)		
	<b>Room A</b> Yang Seungtaik Auditorium, 2F, E9	<b>Room B</b> Chung Kunmo Conference Hall, 5F, E9	<b>Room C</b> KI Fusion Hall, 1F, E4
08:30-10:30	<b>TA1</b> Artificial Muscles and Electro-Active Polymers I	<b>TA2</b> Stretchable and Flexible Electronics II	<b>TA3</b> Energy Harvesting and Storage I
10:30-10:50	Break		
10:50-12:20	<b>TB1</b> Artificial Muscles and Electro-Active Polymers II	<b>TB2</b> 3D and 4D Printing I	<b>TB3</b> Energy Harvesting and Storage II
12:20-13:30	Lunch (Faculty Club, E5)		
13:30-14:30	<b>Plenary Session II (Yang Seungtaik Auditorium, 2F, E9)</b>		
13:30-14:00	Plenary Lecture 3 - Robert Bryant (NASA, USA)		
14:00-14:30	Plenary Lecture 4 - Qibing Pei (UCLA, USA)		
14:30-14:50	Break		
14:50-16:30	<b>TC1</b> Artificial Muscles and Electro -Active Polymers III	<b>TC2</b> 3D and 4D Printing II	<b>TC3</b> Energy Harvesting and Storage III
16:30-16:50	Break		
16:50-18:30	<b>TD1</b> Soft Robotics and Mechatronics III	<b>TD2</b> Space Tech	<b>TD3</b> Energy Harvesting and Storage IV
18:30-19:00	Break		
19:00~21:00	Banquet (Sky Lounge Complex, 5F, E9 Academic Cultural Complex)		

### Oct. 26, 2018

09:00-12:00	<b>FA1</b> Active Materials & Dynamic Systems Trend in Soft Active Materials and Mechatronics (Invitation Only)	Optional Tour (09:00-17:00) UNESCO World Heritage Tour: Baekje Historic Area
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The 3rd International Workshop on Active Materials and Soft Mechatronics

# AMSM2018

October 23-26, 2018

KAIST, Daejeon, Republic of Korea

Hosted by



사단법인  
**한국복합재료학회**  
The Korean Society for Composite Materials



The Korean Society  
of Mechanical Engineers

**KAIST**

Sponsored by



**BK21** 플러스



**INHA IST**  
**NASA**  
Deep Space  
Exploration  
Joint Research Center



**PIRE**

<http://www.piresoftrobots.org>

**DIME**

대전마케팅공사  
Daejeon International Marketing Enterprise



**BHLAB**



**Dr. labella**



**FANE**



The 3rd International Workshop on Active Materials and Soft Mechatronics

# AMSM2018

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## Welcome to AMSM2018!

We are pleased to welcome all participants to KAIST and the 3rd International Workshop on Active Materials and Soft Mechatronics, so called AMSM2018.

The aim of this international workshop is to bring together academic and industrial researchers with common interests in soft sensors and actuators, soft robotics and mechatronics, flexible and wearable electronics, energy harvesting and storage materials and 3D/4D printing. The AMSM2018 attracted an unprecedented 156 presentations from several countries in the world. At this conference, 99 oral talks and 57 posters will be presented.

The conference program is rather dense and rich, offering a considerable variety of topics covered. The oral part of the program consists of 4 Plenary Lectures, 15 Keynote Lectures and several oral talks in 23 oral sessions. Also, to offer the poster presenters better chances to attract attention with their work, some best papers will be selected from the award committee members.

We hope you find this workshop both interesting and stimulating and you enjoy meeting up with old friends and making new contacts. We look forward to receiving your feedback on this workshop.

We would like to extend our thanks to the program committee members, all staffs, student helpers and the extremely dedicated and efficient PCO of the Enlight. Finally we would like to express special thanks to all invited speakers and organizing committee members for their great contribution to this AMSM2018.

Best wishes,

### Organizing Chairs AMSM2018

Prof. Il-Kwon Oh  
(KAIST)

Prof. Hyung-Soon Park  
(KAIST)

Prof. Joo-Hyung Kim  
(Inha University)



## Welcome to AMSM2018!

On behalf of the organizing program committee, it is our pleasure to welcome you to the 3rd International Workshop on Active Materials and Soft Mechatronics (AMSM2018). We hope that this workshop will provide the means for researchers to exchange ideas, through which collaboration can be initiated for the advancement of active functional materials and their applications to sensors and actuators, artificial muscles, soft robotics, flexible and wearable electronics, 3D and 4D printing, and energy harvesting and storage.

The conference begins on Wednesday October 24th, with the opening and plenary session, followed by three parallel sessions on soft actuators and sensors, stretchable and flexible electronics, soft robotics and mechatronics, and carbon nanomaterials and functional composites. On the same day, poster session will be held along with standing dinner buffet. On October 25th, new research topics including artificial muscles and electro-active polymers, 3D and 4D printing, and energy harvesting and storage, will be discussed in three parallel sessions. Following the sessions, all the participants are invited to a banquet on the Sky Lounge Complex, 5F, E9 Academic Cultural Complex. On the morning of the last day, October 26th, an optional tour is scheduled to Baekje Historic Areas (UNESCO World Heritage).

A total of 99 oral and 57 poster presentations have been received. This workshop features 4 plenary talks, 15 keynote speeches, and 27 invited talks. Several distinguished authors that present high quality scientific and engineering work will be selected for honorable awards and recognition. Furthermore, selected articles will be invited to submit their work as a special issue in the following journals: Smart Materials and Structures (IF: 2.963) and Scientific Reports (IF: 4.122).

We take this opportunity to thank the members of the International Steering Committee, Program Committee, and all of the participants for their contributions to make this a valuable and successful workshop.

### Program Chairs AMSM2018

Prof. Seung Tae Choi  
(Chung-Ang University)

Prof. Steve Park  
(KAIST)

Prof. Gi-Woo Kim  
(Inha University)

# Committee Members

## Organizing Chairs

Il-Kwon Oh (KAIST), Hyung-Soon Park (KAIST) and Joo-Hyung Kim (Inha University)

## • *International Steering Committee*

Chairs: Kwang Jin Kim (UNLV) and Kinji Asaka (AIST)

Maurizio Porfiri, New York University, USA

Kam K. Leang, University of Utah, USA

Chulsung Bae, Rensselaer Polytechnic Institute, USA

Hidenori Okuzaki, University of Yamanashi, JAPAN

Hyacinthe Randriamahazaka, Université Paris Diderot

– Paris 7, FRANCE

Alvo Aabloo, University of Tartu, ESTONIA

Takushi Sugino, AIST, JAPAN

Jun Shintake, The University of Electro-Communications,  
JAPAN

Il-Kwon Oh, KAIST, KOREA

## • *Program Committee*

Chairs: Seung Tae Choi (Chung-Ang University), Steve Park (KAIST) and Gi-Woo Kim (Inha University)

Chong Min Koo, KIST, KOREA

Chang-Yong Ko, RERI, KOREA

Chan Woo Park, ETRI, KOREA

Cheol Hoon Park, KIMM, KOREA

Donghyun Hwang, KIST, KOREA

Dukhyun Choi, Kyung Hee University, KOREA

Giuk Lee, Chung-Ang University, KOREA

Hak-Sung Kim, Hanyang University, KOREA

Han Sung Kim, Yonsei University, KOREA

Hasuk Bae, Ewha Womens University, KOREA

Hugo Rodrigue, Sungkyunkwan University, KOREA

Jae-Hyun Kim, KIMM, KOREA

Jaeyoung Park, KIST, KOREA

Jeong-Yun Sun, Seoul National University, KOREA

Ji Sik Kim, Kyungpook National University, KOREA

Jonghwan Suhr, Sungkyunkwan University, KOREA

Joo-Ho Lee, Ritsumeikan University, JAPAN

Joonbum Bae, UNIST, KOREA

Jung-Ryul Lee, KAIST, KOREA

Ki-Uk Kyung, KAIST, KOREA

Kye-Si Kwon, Soonchunhyang University, KOREA

Kyoung Kwan Ahn, University of Ulsan, KOREA

Myung-Gil Kim, Chung-Ang University, KOREA

Seong Su Kim, KAIST, KOREA

Seungbeum Suh, KIST, KOREA

Seung-Hwan Chang, Chung-Ang University, KOREA

Seunghyun Baik, Sungkyunkwan University, KOREA

Seung-Won Kim, KIST, KOREA

Sung Kyu Park, Chung-Ang University, KOREA

Sungryul Yun, ETRI, KOREA

Sun Kon Lee, Inha University, KOREA

Tae Hoon Lee, Kwangwoon University, KOREA

Wonoh Lee, Chonnam National University, KOREA

Won Seok Chang, KIMM, KOREA

Yong Tae Park, Myongji University, KOREA

Young-Bin Park, UNIST, KOREA

Youngsu Cha, KIST, KOREA

Yun-Sung Lee, Chonnam National University, KOREA

## Sponsors / Exhibition

### Sponsorship Package

Category		Diamond	Gold	Silver
Amount (WON)		5,000,000	3,000,000	1,500,000
B E N E F I T	Complimentary Registration	3 Persons	2 Persons	1 Person
	Complimentary Exhibition Booth	1 Booth	1 Booth	1 Booth
	Advertisement in Program Book	1 Page	1 Page	1 Page
	Logo in Program Book	O	O	O
	Logo Size on Website with Hyperlink	Extra Large	Large	Medium
	Logo Exposure during Banquet	O	O	O

### Exhibition

- Exhibition Details
  - Period : October 23-26, 2018
  - Place : KAIST, Daejeon, Republic of Korea
  - Participants : Institutes, societies, and companies related to Active Materials and Soft Mechatronics
- Exhibition Booth Rate: 1,500,000 WON/ 1 Booth
- Provided Benefits
  - A table, 1 socket(220v), 2 chairs, power(1kW)
  - \* In case you need an extra power and LAN at your booth, please let us know in advance.

### Advertisement

Category		Amount (WON)
Advertising On (Full color)	Front Cover (2 Covers)	1,500,000
	Back Cover (3 Covers)	1,500,000
	Inner 1P (page 1)	1,000,000

- The file of advertisement should be created by the company.
- All the advertisements will be printed in full color.

For more details, please visit the official website(<http://amsm2018.org>).

# General Information

## [Registration]

### \* Registration Fees

Category	Early Registration By September 15, 2018	Standard Registration By October 15, 2018	On-Site Registration October 23-26, 2018
<b>Regular</b>	USD 400 (KRW 440,000)	USD 450 (KRW 495,000)	USD 500 (KRW 550,000)
<b>Student</b>	USD 300 (KRW 330,000)	USD 350 (KRW 385,000)	USD 400 (KRW 440,000)

Processed in Korean Won (USD 1 = KRW 1,100)

## [Notice]

- All attendees are required to register and to pay the appropriate registration fee in order to participate in any capacity at the conference.
- Regular and student registrations include access to the plenary lectures, invited lectures, oral sessions, a poster session, lunch and banquet.
- Additional Banquet Ticket USD70/KRW77,000: Regular fee includes a BANQUET Ticket for one person. This is for accompanying persons.

### \* Payment Method

- Credit Card (VISA, MASTER, JCB, AMEX, Union Pay)
- Bank Transfer

### \* Cancellation Policy

- Until September 15, 2018: 100% Refund (Exclusive of Banking Charges)
- After September 16, 2018: No Refund

### \* Registration at the conference

Cash and credit card will be accepted. The registration fee includes refreshment breaks, conference abstract book and materials. Registration and general information is available at the registration desk. The following dates and times are the schedule for registration.

### Place: KAIST Academic Cultural Complex, 1F, E9

<b>Oct. 23</b>	Tuesday	16:00-19:00
<b>Oct. 24~25</b>	Wednesday - Thursday	08:00-18:00

# Hotel Information

We kindly ask you to book your hotel room on your own by using the Hotel's links. When you check in the hotel, please make sure to let them know that you are attending AMSM2018 organized by KAIST.

## Hotel ICC

***<http://www.hotelicc.com/eng/index.do>***

**Phone** +82-42-866-5000

**Address** 55, Expo-ro 123beon-gil, Yuseong-gu, Daejeon, Republic of Korea

## Lotte City Hotel

***<https://www.lottehotel.com/daejeon-city/en.html>***

**Phone** +82-42-333-1000

**Address** 33, Expo-ro 123beon-gil, Yuseong-gu, Daejeon, Republic of Korea

## Toyoko Inn – Daejeon Govenment Complex

***[https://www.toyoko-inn.com/search/detail/00234?lcl\\_id=en](https://www.toyoko-inn.com/search/detail/00234?lcl_id=en)***

**Phone** +82- 42-545-1045

**Address** 35209 13, Dunsanjung-ro 134beon-gil, Seo-gu, Daejeon, Republic of Korea

\* Transportation (buses) will be provided between these three hotels and venue KAIST.

\* Other hotels are also available in the downtown area (Doosan) in Daejeon, however people have to organize the transportations themselves.

## Optional Tour

### UNESCO World Heritage Tour – Baekje Historic Areas

- Date & Time: 09:00~17:00, Oct 26 (Fri)
- Tour fee: USD 30 (KRW 30,000), all charges included
- Course: Gongsangsung Fortress – The Royal Tombs of Baekje – Lunch – Gongju Korean Folk Village (Experience of Tea Ceremony and making Korean confectionery) – Gongju National Museum – Hotel

### Gongsangsung Fortress - The Royal Tombs of Baekje

[http://www.baekje-heritage.or.kr/html/en/historic/historic\\_010201.html](http://www.baekje-heritage.or.kr/html/en/historic/historic_010201.html)



### Gongju Korean Folk Village

[http://www.gongju.go.kr/hanok/sub06\\_01\\_01.do](http://www.gongju.go.kr/hanok/sub06_01_01.do)



### Gongju National Museum

<http://gongju.museum.go.kr/html/en/>



## Conference Topics

- 1. Soft Actuators and Sensors**
- 2. Artificial Muscles and Electro-Active Polymers**
- 3. Soft Robotics and Mechatronics**
- 4. Graphene and 2D Materials**
- 5. Functional Materials and Composites**
- 6. Stretchable and Flexible Electronics**
- 7. Energy Harvesting and Energy Storage Materials**
- 8. 3D and 4D Printing**
- 9. Space Tech (IST-NASA)**

# Invited Speakers

## Plenary Speakers



**Geoff Spinks**  
(Uni. Wollongong, Australia)



**Jang-Kyo Kim**  
(HKUST, Hong Kong)



**Qibing Pei**  
(UCLA, USA)



**Robert Bryant**  
(NASA, USA)

## Keynote Speakers

- Alvo Aabloo (Univ. of Tartu, Estonia)
- Chang-Woo Lee (KITECH, Korea)
- Chong-Yun Kang (KIST, Korea)
- Haeshin Lee (KAIST, Korea)
- Jae-Hung Han (KAIST, Korea)
- Jae-Hyun Kim (KIMM, Korea)
- Kam K. Leang (University of Utah, USA)
- Kinji Asaka (AIST, Japan)
- Kwang Jin KIM (UNLV, USA)
- Sang H. Choi (NASA Langley Research Center, USA)
- Sang-Young Lee (UNIST, Korea)
- Seon Jeong Kim (Hanyang Univ., Korea)
- Seunghyun Baik (SKKU, Korea)
- Steve Park (KAIST, Korea)
- Yoong Ahm Kim (CNU, Korea)

## Invited Speakers

- Chan Woo Park (ETRI, Korea)
- Cheol Hoon Park (KIMM, Korea)
- Gi-Woo Kim (Inha Univ., Korea)
- Ho Seok Park (SKKU, Korea)
- Hugo Rodrigue (SKKU, Korea)
- Hyung Wook Park (UNIST, Korea)
- Jeong Min Baik (UNIST, Korea)
- Jeong-Yun Sun (SNU, Korea)
- Jin Han Jeon (Robert Bosch (SEA), Singapore)
- Joo-Ho Lee (Ritsumeikan Univ., Japan)
- Kye-Si Kwon (Soonchunhyang Univ., Korea)
- Maurizio Porfiri (New York Univ., USA)
- Myung-Gil Kim (CAU, Korea)
- Myung-Hyun Ryou (HNU, Korea )
- Robert W. Moses (NASA, USA)
- Seung Tae Choi (CAU, Korea)
- Seung-Hyub Baek (KIST, Korea)
- Shinichi Hirai (Ritsumeikan Univ., Japan)
- Sungryul Yun (ETRI, Korea)
- Tae Hoon Lee (Kwangwoon Univ., Korea)
- Takushi Sugino (AIST, Japan)
- Won Seok Chang (KIMM, Korea)
- Won-Sub Yoon (SKKU, Korea)
- Young-Si Jun (CNU, Korea )
- Zicai Zhu (Xi'an Jiaotong Univ., China)
- Zong-Hong Lin (NTHU, Taiwan)
- Zunfeng Liu (Nankai Univ., China)



# Instruction for Presentation

First of all, we would like to welcome all of you to AMSM2018, KAIST, Daejeon, Republic of Korea. Thank you for presenting your studies in the workshop. To make sure that all sessions run smoothly, we provide the following brief guidelines for all authors to follow:

## Oral Presentation Sessions

- Please try to arrive at the meeting room of your presentation session at least 20 minutes before the start of the session.
- Please upload your PowerPoint file onto the computer for presentation and make sure that your file runs appropriately.
- Please introduce yourself to your session chair so that the session chair will know who is presenting the paper.
- Time management is VERY critical because people may switch between sessions for presentations that they are interested in.

## Poster Sessions

- Please try to arrive at the meeting area of your poster session at least 20 minutes before the start of the session.
- Please post your posters on the poster board designated to you.
- During your poster session, please be around the poster board designated to you in order to interact with participants who are interested in your study.
- After your poster session, please help remove your posters from the board so that the author(s) of the next poster session can put their posters on the board.
- Drawing pins will be supplied to mount posters. It is advisable to present the poster in a clear and legible format.
- The poster board size is W95 X H240 cm.

# Conference Site Map

## Conference Venue

- **Academic Cultural Complex (E9)**

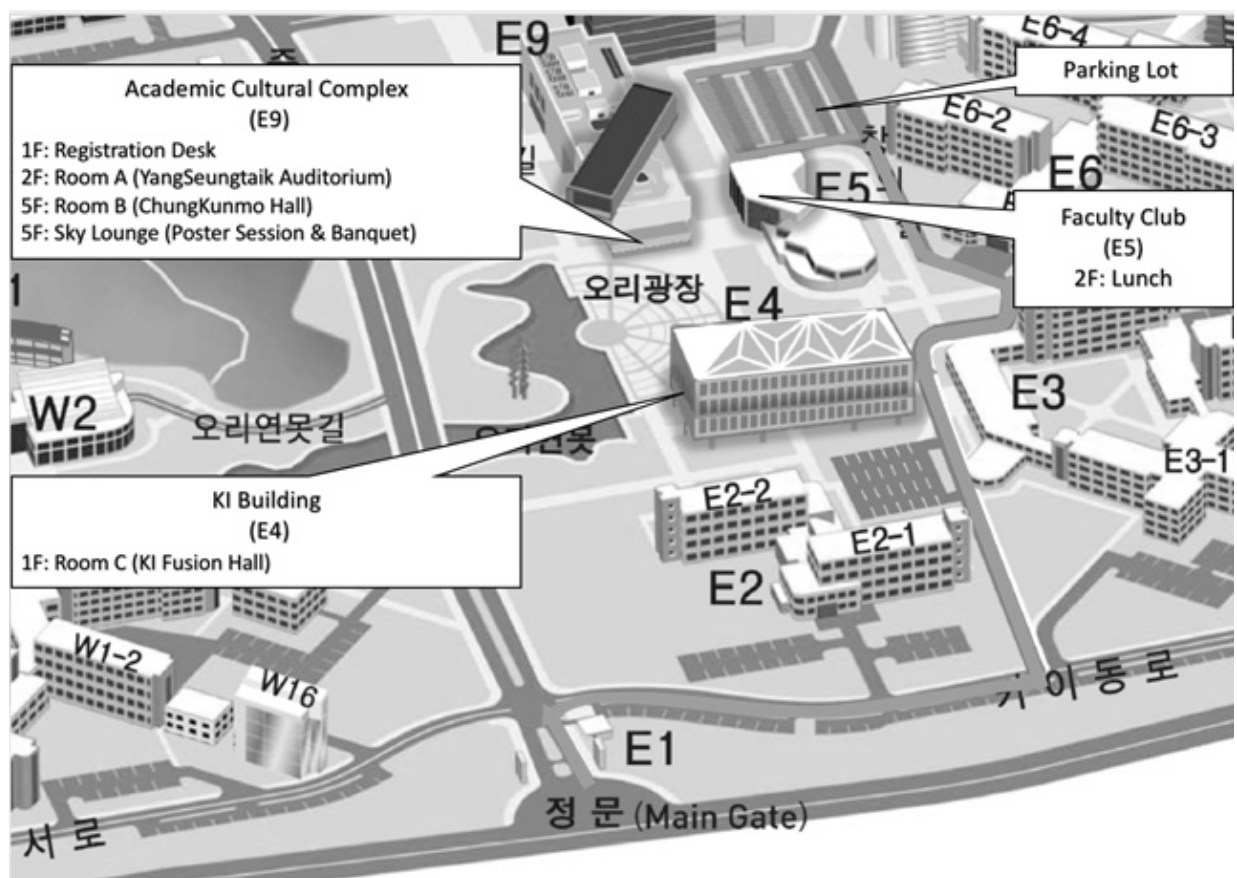
: Registration Desk (1F), Room A (2F), Room B (5F), Sky Lounge (5F, Poster Session & Banquet)

- **KI Building (E4)**

: Room C (1F)

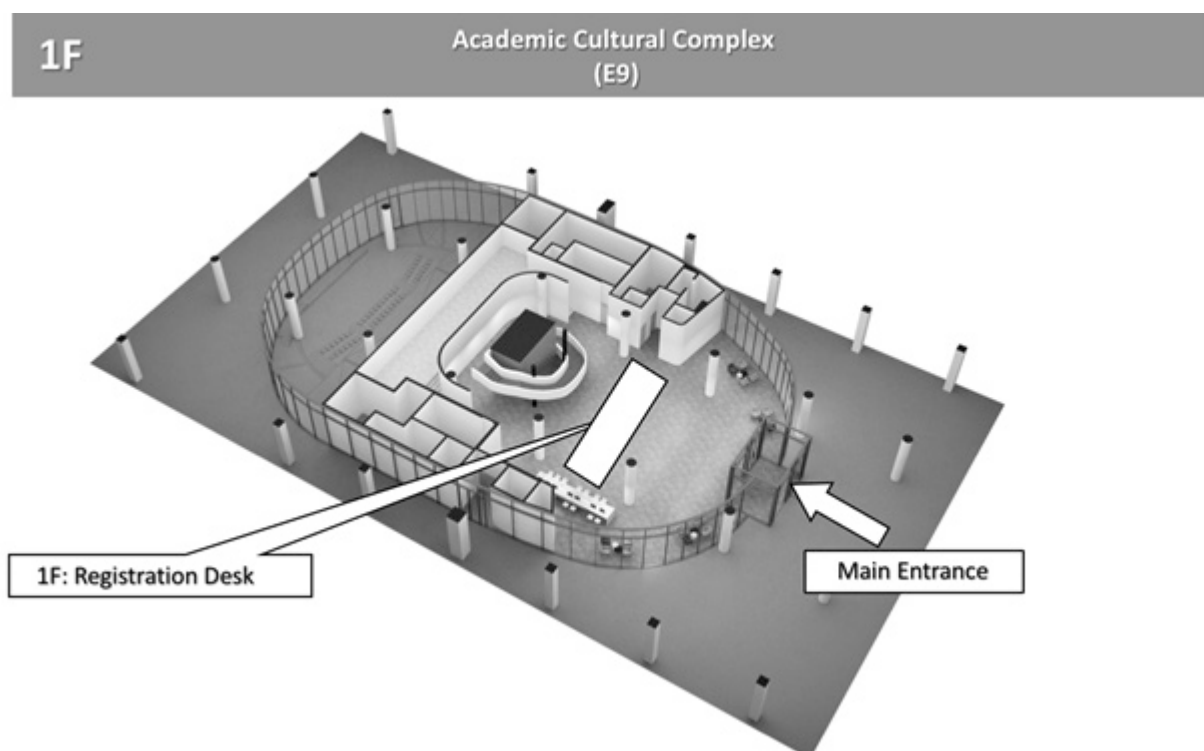
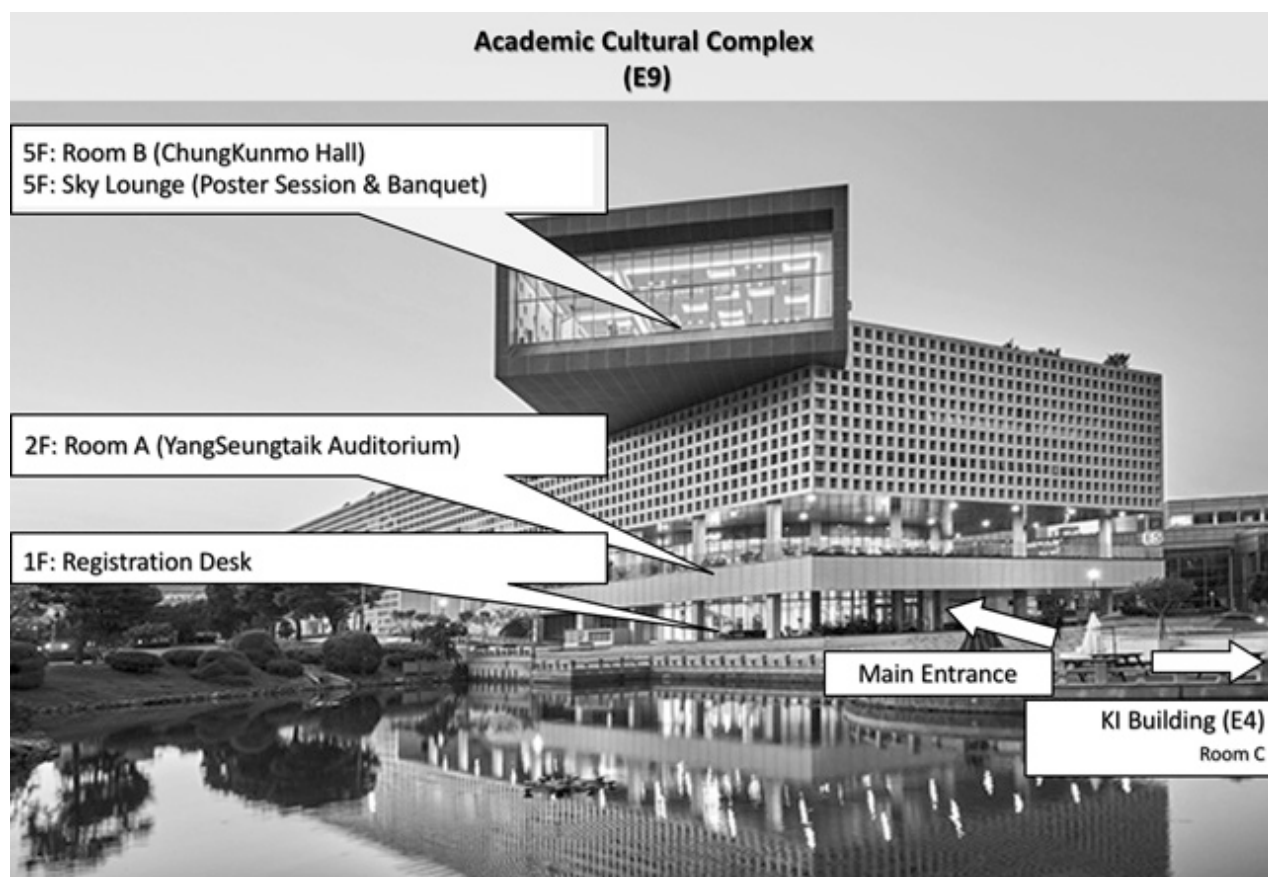
- **Faculty Club (E5)**

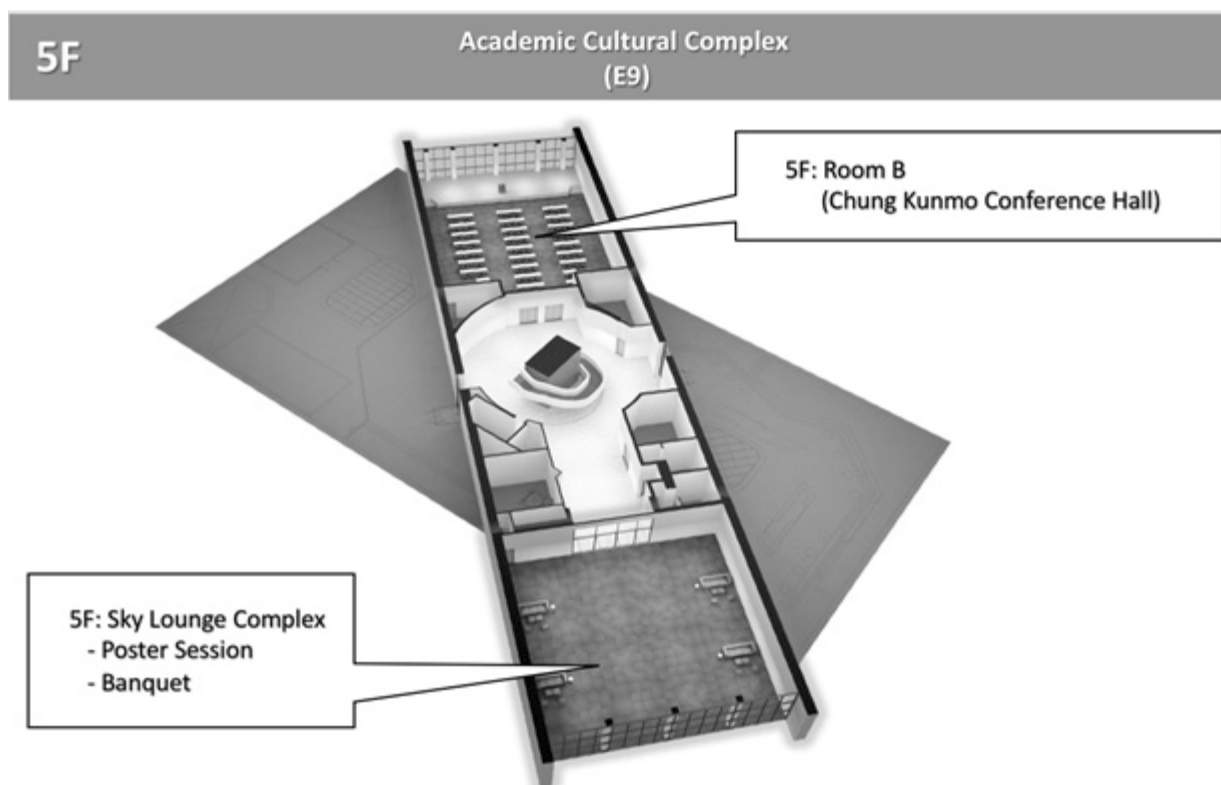
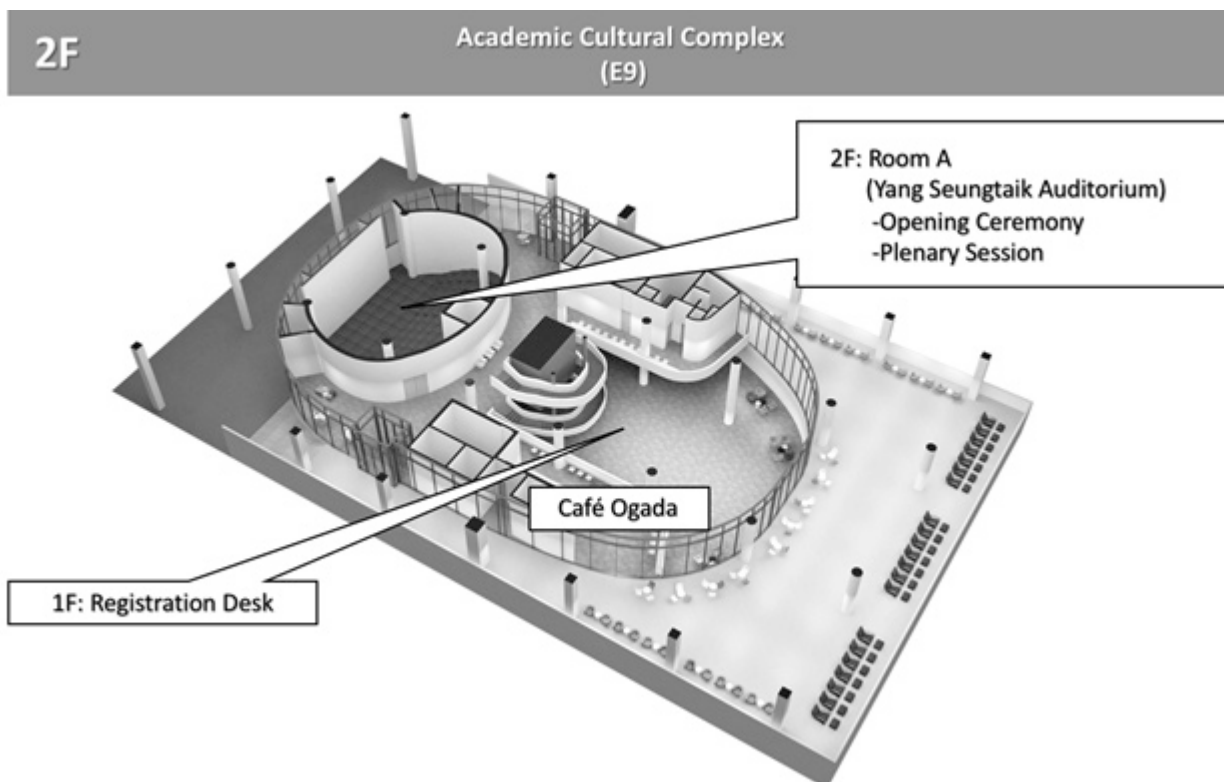
: Lunch (2F)



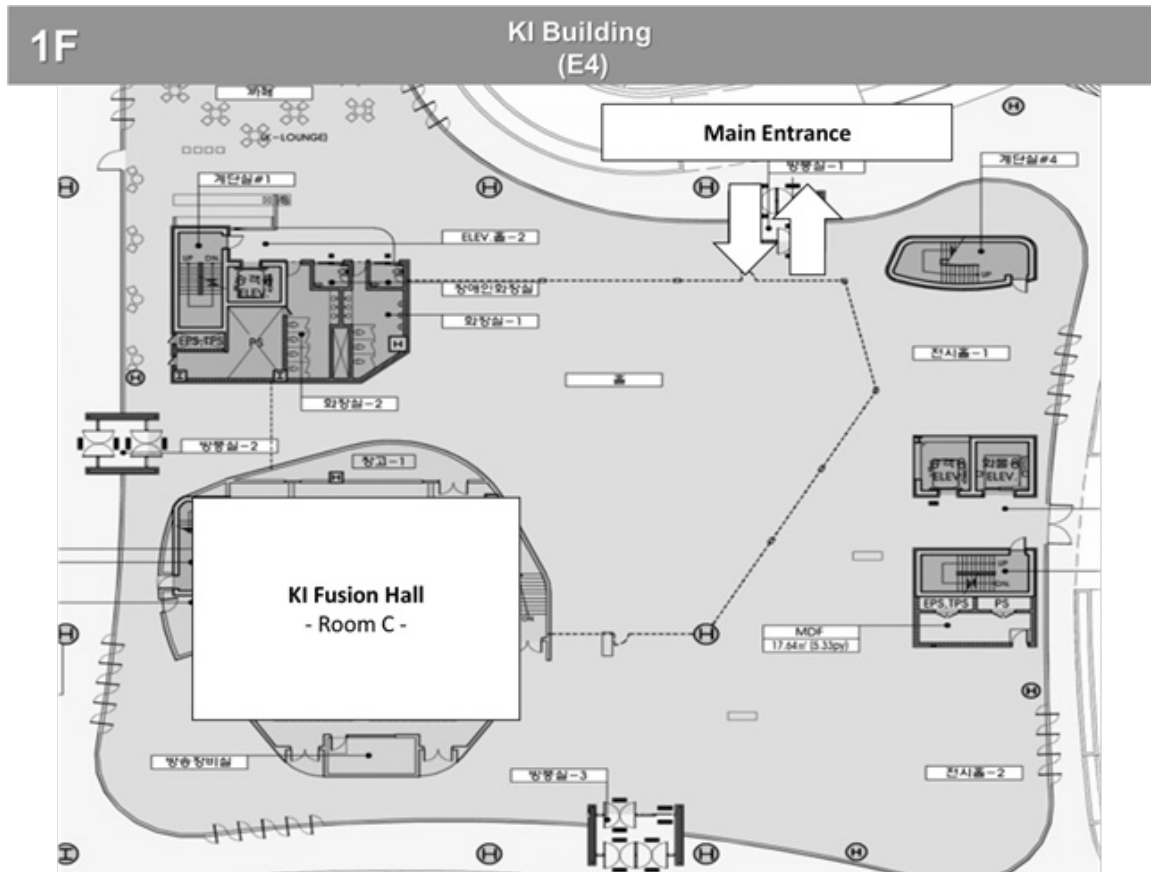
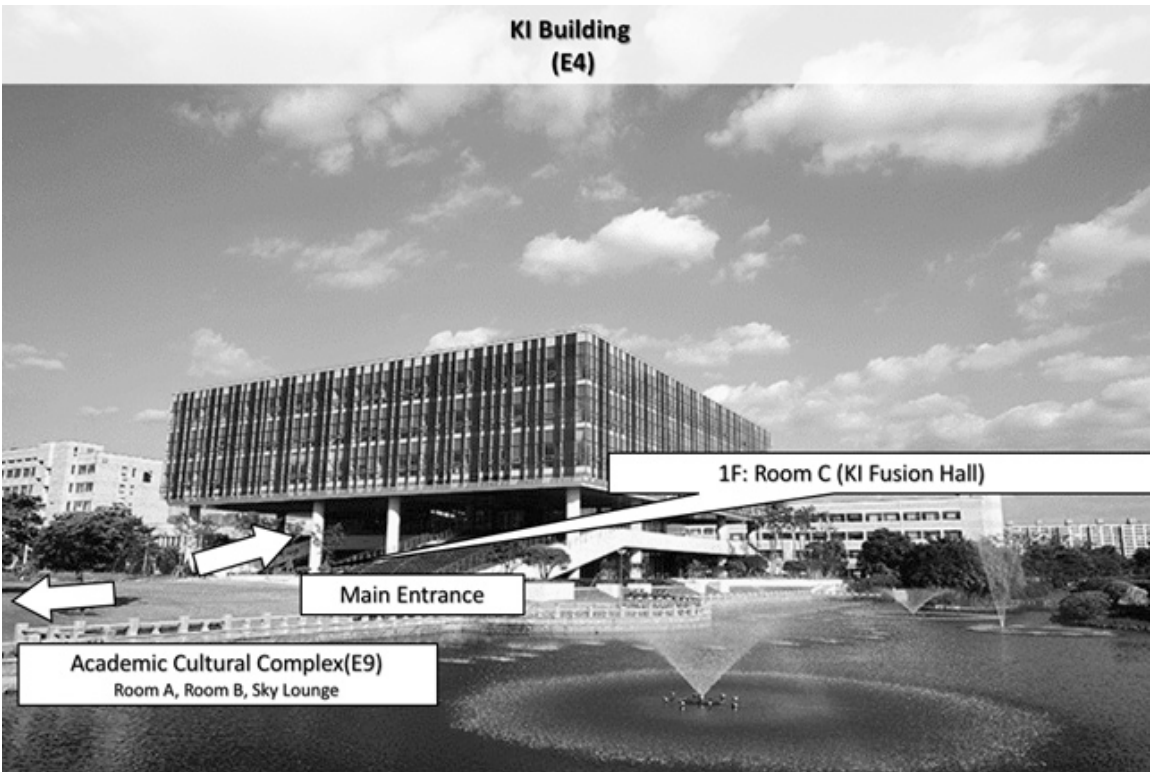
## Floor Plan

### • Academic Cultural Complex (E9)





• KI Building (E4)



The 3rd International Workshop on Active Materials and Soft Mechatronics

# AMSM2018

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## TECHNICAL PROGRAMS



# Program

## October 24, 2018 (Wednesday)

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### Plenary Lecture I

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October 24 (Wed.), 09:00~10:00, Yang Seungtaik Auditorium, 2F, E9

**PL1-1** 09:00-09:30

**[Plenary] Turning Twist into Tension in Highly Twisted and Coiled Fibres**

*\*Geoffrey M. Spinks (University of Wollongong, Australia)*

**PL2-1** 09:30-10:00

**[Plenary] Roles of Nanocarbon in High-Performance Rechargeable Batteries**

*\*Jang-Kyo Kim (The Hong Kong University of Science & Technology, Hong Kong)*

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### WA1 - Soft Actuators and Sensors I

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October 24 (Wed.), 10:20~12:00, Yang Seungtaik Auditorium, 2F, E9

Session Chair: Sungryul Yun (Electronics and Telecommunications Research Institute, Korea)

**WA1-1** 10:20-10:40

**[Invited] Shape Memory Alloy-based Tendons for High Performance Soft Actuation**

*Ji-Hyeong Lee, Yoon Seop Chung, \*Hugo Rodrigue (Sungkyunkwan University, Korea)*

**WA1-2** 10:40-11:00

**[Invited] Actuation Performance of SMA Spring Bundle Actuator**

*\*Cheol Hoon Park, Seong Jun Park, Sang Yong Ham, Young Su Son (Korea Institute of Machinery and Materials, Korea)*

**WA1-3** 11:00-11:20

**Deployment Performance of Shape Memory Polymer Composite Hinge at Low Temperature**

*Van Luong Le, \*Nam Seo Goo (Konkuk University, Korea), Woong-Ryeol Yu (Seoul National University, Korea)*

**WA1-4** 11:20-11:40

**Tough and Biocompatible Magneto-Responsive Fe<sub>3</sub>O<sub>4</sub> Nanoparticles-Embedded Poly(N,N-dimethylacrylamide)/Clay Nanocomposite Hydrogels**

*Hyo Seon Jang, In Hye Park, Hyoung Jin Choi, \*Jin Hyun Lee (Inha University, Korea)*

**WA1-5** 11:40-12:00

**A Soft Tactile Actuator based on Dielectric Elastomer Actuator for Wearable Interface**

*Jung-Hwan Youn, Seung-Mo Jeong, Young-Seok Choi, \*Ki-Uk Kyung (Korea Advanced Institute of Science and Technology, Korea)*



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## **WA2 - Stretchable and Flexible Electronics I**

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October 24 (Wed.), 10:20~12:20, Chung Kunmo Conference Hall, 5F, E9

Session Chair: Seung Tae Choi (Chung-Ang University, Korea)

**WA2-1**      **10:20-10:50**

**[Keynote] Roll-based Transfer Technology for Manufacturing Flexible Devices of High Performance**

*\*Jae-Hyun Kim (Korea Institute of Machinery and Materials, Korea)*

**WA2-2**      **10:50-11:20**

**[Keynote] Synthesis of Nanoscale Fillers for Soft Conductive Composites and Fibers**

*\*Seunghyun Baik (Sungkyunkwan University, Korea)*

**WA2-3**      **11:20-11:40**

**[Invited] Liquid Metal Electrodes for Monolithically Integrated Stretchable Circuits**

*\*Chan Woo Park (Electronics and Telecommunications Research Institute, Korea)*

**WA2-4**      **11:40-12:00**

**[Invited] Laser Based Patterning and Measurement Technology for Flexible Electronics**

*Seok Young Ji (Korea University of Science and Technology, Korea), \*Won Seok Chang (Korea Institute of Machinery and Materials, Korea)*

**WA2-5**      **12:00-12:20**

**[Invited] Hierarchically Buckled Structures for Stretchable Electronics**

*\*Zunfeng Liu (Nankai University, China)*

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## **WA3 - Carbon Nanomaterials and Functional Composites I**

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October 24 (Wed.), 10:20~12:10, KI Fusion Hall, 1F, E4

Session Chair: Wonoh Lee (Chonnam National University, Korea)

**WA3-1**      **10:20-10:50**

**[Keynote] Substitutionally Boron-Doped Graphene**

*\*Yoong Ahm Kim (Chonnam National University, Korea)*

**WA3-2**      **10:50-11:10**

**Chitosan-Graphene Oxide Foams Fabricated by Freeze-Casting Process**

*Stephanie Kyunghbin Lee (Sungkyunkwan University, Korea), Jin Hyun Lee (Inha University, Korea),*

*\*Jonghwan Suhr (Sungkyunkwan University, Korea)*

**WA3-3**      **11:10-11:30**

**Synthesis of Heavily Nitrogen-doped Chemically Exfoliated Graphene by Flash Heating Method**

*Seol Yoo (University of Science and Technology (UST), Korea), Soo Yeon Jeong, Jae Won Lee, Jong Hwan Park, Hee Jin Jeong, Joong Tark Han, Geon-Woong Lee (Korea Electrotechnology Research Institute (KERI), Korea), \*SeungYol Jeong (University of Science and Technology (UST), Korea)*

**WA3-4 11:30-11:50****Graphene Based Two-Dimensional Hybrid Additives for Magnetorheological Fluids**

Muhammad Taha Manzoor, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)

**WA3-5 11:50-12:10****Freestanding Cu-Ni Core-shell Nanowires Affixed to Woven Kevlar® Fiber/Polydimethylsiloxane/Reduced Graphene Oxide Composite**

Ankita Hazarika, Biplab K. Deka, Do-Young Kim, Young-Bin Park, \*Hyung Wook Park (Ulsan National Institute of Science and Technology (UNIST), Korea)

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**WB1 - Soft Actuators and Sensors II**

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**October 24 (Wed.), 13:30~15:10, Yang Seungtaik Auditorium, 2F, E9**

Session Chair: Hugo Rodrigue (Sungkyunkwan University, Korea)

**WB1-1 13:30-13:50****[Invited] An Active-Lens Module Based Tunable Optical System for Dynamically-Controllable Optical Zoom**

Dongbum Pyo, Suntak Park, Seongcheol Mun, Bongje Park, Seung Koo Park, \*Sungryul Yun (Electronics and Telecommunications Research Institute, Korea)

**WB1-2 13:50-14:10****[Invited] Fluorinated Polymer-Based Sensors and Actuators: Hurdles to Commercialization**

\*Seung Tae Choi (Chung-Ang University, Korea)

**WB1-3 14:10-14:30****A Novel All-in-one Soft Sensor Embedded Glove based on Direct Ink Writing of Eutectic Gallium Indium**

Suin Kim, Dahee Jeong, Wookeun Park, \*Joonbum Bae (Ulsan National Institute of Science and Technology, Korea)

**WB1-4 14:30-14:50****Passive Hand Extension Device for Rehabilitation of Patients Post-Stroke**

Dong Hyun Kim, \*Hyung-Soon Park (Korea Advanced Institute of Science and Technology, Korea)

**WB1-5 14:50-15:10****SHM System for Damage Detection of Composite Laminates Using Smart Composite Fabrics**

Kyung-Chae Jung, \*Seung-Hwan Chang (Chung-Ang University, Korea)

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## **WB2 - Soft Robotics and Mechatronics I**

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**October 24 (Wed.), 13:30~15:20, Chung Kunmo Conference Hall, 5F, E9**

Session Chair: Hyung-Soon Park (Korea Advanced Institute of Science and Technology, Korea)

### **WB2-1 13:30-14:00**

#### **[Keynote] On-Off Actuator Using Buckled Bistable Beam**

*\*Jae-Hung Han, Reynolds Addo-Akoto (Korea Advanced Institute of Science and Technology, Korea),  
Choon-Gil Kang (ADD, Korea), Jun-Seong Lee (KARI, Korea)*

### **WB2-2 14:00-14:20**

#### **[Invited] Soft Robotic Automation**

*\*Shinichi Hirai (Ritsumeikan University, Japan)*

### **WB2-3 14:20-14:40**

#### **Solvent-free PVC Gel based Varifocal Micro-lens**

*Eun-Jae Shin, Won-Hyeong Park, \*Sang-Youn Kim (Korea University of Technology and Education, Korea)*

### **WB2-4 14:40-15:00**

#### **Soft Twisted String Actuator Module for Wearable Robotic Applications**

*\*Bhivraj Suthar, Igor Gaponov, Jee Hwan Ryu (Korea University of Technology and Education, Korea)*

### **WB2-5 15:00-15:20**

#### **Carbon Fiber Reinforced Electro-adhesion Pad for a Soft Gripper**

*Geonwoo Hwang (Korea Advanced Institute of Science and Technology (KAIST), Korea), Ibrahim Bin Yasir  
(National University of Sciences and Technology (NUST), Pakistan), Kyujin Hyeon, \*Ki-Uk Kyung (Korea  
Advanced Institute of Science and Technology (KAIST), Korea)*

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## **WB3 - Carbon Nanomaterials and Functional Composites II**

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**October 24 (Wed.), 13:30~15:00, KI Fusion Hall, 1F, E4**

Session Chair: Young-Bin Park (Ulsan National Institute of Science and Technology, Korea)

### **WB3-1 13:30-14:00**

#### **[Keynote] Mussel- and plant-inspired Adhesive Chemistry in Graphene Technology**

*\*Haeshin Lee (Korea Advanced Institute of Science and Technology, Korea)*

### **WB3-2 14:00-14:20**

#### **Properties of Composite Pastes Using Microwave Treated Graphene Compositing with Polyaniline or Silver for Electrode**

*Young-il Na, Dae-seok Seo, Han-Young Jung, Hyun-Jun Kwon, Jong-Hwan Park, Se Hee Shin, Sun-Woo  
Kim, Jung-woo Lee, Hwa Sun Park, Yong soo Oh, \*Su-Jeong Suh (Sungkyunkwan University, Korea)*

### **WB3-3 14:20-14:40**

#### **Two-step Cross-linked Graphene Oxide based Aerogels and the Applications**

*Yan Sun, \*Jonghwan Suhr (Sungkyunkwan University, Korea)*

**WB3-4 14:40-15:00****A Study of Improvement Damage Sensing Resolution and Self-Healing Efficiency of Carbon Fiber/Polypropylene Composite Based on Addressable Conducting Network**

Sung-Jun Joo, Myeong-Hyeon Yu, \*Hak-Sung Kim (Hanyang University, Korea)

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**WC1 - Soft Actuators and Sensors III**

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October 24 (Wed.), 15:30~17:10, Yang Seungtaik Auditorium, 2F, E9

Session Chair: Kam K Leang (University of Utah, USA)

**WC1-1 15:30-15:50****[Invited] Through-the-thickness Deformations of Ionic Polymer Metal Composites**

Alain Boldini, \*Maurizio Porfiri (New York University, USA)

**WC1-2 15:50-16:10****Audio-Tactile Skinny Buttons for Flexible User Interfaces**

Quang Van Duong, \*Seung Tae Choi (Chung-Ang University, Korea)

**WC1-3 16:10-16:30****Friction Controllable Tendon-Driving Actuation by Using Hygroscopic Deformation of Polymer Tube**

Kyoung-Soub Lee, Jae-Bum Pyo, Taek-Soo Kim, \*Hyung-Soon Park (Korea Advanced Institute of Science and Technology, Korea)

**WC1-4 16:30-16:50****Soft Thin Integrated Pressure Sensor and Vibrotactile Actuator**

SiHo Ryu, Dong-Soo Choi, \*Sang-Youn Kim (Korea University of Technology and Education, Korea)

**WC1-5 16:50-17:10****High-precision Position Control of Soft Actuator Systems**

Cong Phat Vo, \*Kyoung Kwan Ahn (University of Ulsan, Korea)

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**WC2 - Soft Robotics and Mechatronics II**

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October 24 (Wed.), 15:30~17:10, Chung Kunmo Conference Hall, 5F, E9

Session Chair: Youngsu Cha (Korea Institute of Science and Technology, Korea)

**WC2-1 15:30-15:50****[Invited] Toward Efficient Environment: Reconfigurable Intelligent Space**

\*Joo-Ho Lee, Tatsuki Satooka, Hirotake Yamazoe (Ritsumeikan University, Japan)

**WC2-2 15:50-16:10****Variable Stiffness Mechanism with Low Melting Point Materials for Medical Applications**

\*Seung-Won Kim (Korea Institute of Science and Technology, Korea)

**WC2-3 16:10-16:30**

**Micro/BioRobot-Enabled Drug Delivery Systems**

*\*SeungBeum Suh (Korea Institute of Science and Technology, Korea), Bahareh Behkam (Virginia Tech, USA)*

**WC2-4 16:30-16:50**

**Development of Compact Surgical-instrument Drivers for Neurosurgical Robots**

*Namseon Jang, Yong Seok Ihn, Sehyuk Yim, Jinwoo Jeong, Keehoon Kim, Sang-Rok Oh, \*Donghyun Hwang (Korea Institute of Science and Technology, Korea)*

**WC2-5 16:50-17:10**

**Wearable Glove for Human-VR Interface**

*Sung Hee Kim, Sungho Jin, Yunbyeong Chae, \*Youngsu Cha (Korea Institute of Science and Technology, Korea)*

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**WC3 - Carbon Nanomaterials and Functional Composites III**

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**October 24 (Wed.), 15:30~17:10, KI Fusion Hall, 1F, E4**

Session Chair: Jonghwan Suhr (Sungkyunkwan University, Korea)

**WC3-1 15:30-15:50**

**[Invited] Fabrication and Synthesis of the Multifunctional Nanowire Woven Carbon Composite**

*Anikta Hazarika, Biplab K. Deka, \*Hyung Wook Park (Ulsan National Institute of Science and Technology, Korea)*

**WC3-2 15:50-16:10**

**Progressive Failure Analysis of Shear Deformed Twill Woven Composites Based on Multi-Scale Modeling**

*Yeon-Taek Hwang, Kyung-Hee Choi (Hanyang University, Korea), Jae-Young Lim, Byeung-Gun Nam (Hyundai Motor Company, Korea), \*Hak-Sung Kim (Hanyang University, Korea)*

**WC3-3 16:10-16:30**

**Technique for Changing Transmission Frequency of Stealth Radome Applied with Frequency Selective Surface Film**

*Dae-Sung Son, Jong-Min Hyun, \*Jung-Ryul Lee (Korea Advanced Institute of Science and Technology, Korea)*

**WC3-4 16:30-16:50**

**Study on the Conformation of Crystalline Structure In PVDF/PVA Composite Film**

*Hyun Soo Hong, \*Seong Su Kim (Korea Advanced Institute of Science and Technology, Korea)*

**WC3-5 16:50-17:10**

**Bimetallic Copper Cobalt Selenide Nanowire-Anchored Woven Carbon Fiber-Based Structural Supercapacitors**

*\*Biplab K. Deka, Ankita Hazarika, Jisoo Kim, Young-Bin Park, \*Hyung Wook Park (Ulsan National Institute of Science and Technology (UNIST), Korea)*

## October 25, 2018 (Thursday)

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### TA1 - Artificial Muscles and Electro-Active Polymers I

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October 25 (Thur.), 08:30~10:20, Yang Seungtaik Auditorium, 2F, E9

Session Chair: Kwang Jin Kim (University of Nevada at Las Vegas, USA)

**TA1-1** 08:30-09:00

**[Keynote] Active Carbon Ionic Capacitive Laminates: Towards Operation in Fluids**

*\*Alvo Aabloo (University of Tartu, Estonia)*

**TA1-2** 09:00-09:20

**[Invited] Actuation Mechanism of Nanocarbon Polymer Actuators**

*\*Takushi Sugino, Yoshiyuki Shibata, Kenji Kiyohara, Kinji Asaka (National Institute of Advanced Industrial Science and Technology (AIST), Japan)*

**TA1-3** 09:20-09:40

**[Invited] Application Promotion of IPMC Actuator and Sensor**

*\*Zicai Zhu, Changsheng Bian, Ximing He, Wanfa Bai (Xi'an Jiaotong University, China)*

**TA1-4** 09:40-10:00

**Highly Bendable Ionic Soft Actuator Based on Carboxylated Bacterial Cellulose Membrane and Polypyrrole Electrode**

*Fan Wang, Qinchuan Li (Zhejiang Sci-Tech University, China), \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

**TA1-5** 10:00-10:20

**Design and Synthesis of PS-b-PSS Block Copolymer Electrolytes for Electroactive Artificial Muscles**

*Van Hiep Nguyen, Jaehwan Kim (Korea Advanced Institute of Science and Technology, Korea), Kwang Jin Kim (University of Nevada at Las Vegas, USA), \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

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### TA2 - Stretchable and Flexible Electronics II

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October 25 (Thur.), 08:30~10:20, Chung Kunmo Conference Hall, 5F, E9

Session Chair: Sung Kyu Park (Chung-Ang University, Korea)

**TA2-1** 08:30-09:00

**[Keynote] Design of Tactile Sensors for Electronic Skin Applications**

*\*Steve Park (Korea Advanced Institute of Science and Technology, Korea)*

**TA2-2 09:00-09:20**

**[Invited] Stretchable Ionics – A Promising Candidate for Oncoming Wearable Devices**

*\*Jeong-Yun Sun (Seoul National University, Korea)*

**TA2-3 09:20-09:40**

**[Invited] Organic-Inorganic Hybrid Materials for Advanced Functionality Development in Large Area Electronics**

*\*Myung-Gil Kim, Sung Kyu Park (Chung-Ang University, Korea), Choongik Kim (Sogang University)*

**TA2-4 09:40-10:00**

**[Invited] Organic-2D Heterostructure based Transistors for Flexible Electronics**

*\*Tae Hoon Lee (Kwangwoon University, Korea)*

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## **TA3 - Energy Harvesting and Storage I**

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**October 25 (Thur.), 08:30~10:00, KI Fusion Hall, 1F, E4**

Session Chair: Yun-Sung Lee (Chonnam National University, Korea)

**TA3-1 08:30-09:00**

**[Keynote] Form Factor-Free, Printed Power Sources**

*\*Sang-Young Lee (Ulsan National Institute of Science and Technology, Korea)*

**TA3-2 09:00-09:20**

**[Invited] Micro-Patterned Li Metal to Inhibit Dendrite Formation for Li Metal Anodes**

*\*Myung-Hyun Ryou (Hanbat National University, Korea)*

**TA3-3 09:20-09:40**

**[Invited] Discovering of Exceptional Li Storage In Nanostructured Electrode Materials for Next Generation Li Batteries**

*Jaesang Yoon, Taewhan Kim, Woosung Choi, Hyunwoo Kim, \*Won-Sub Yoon (Sungkyunkwan University, Korea)*

**TA3-4 09:40-10:00**

**[Invited] High Performance Flexible Na Hybrid Capacitors: From Pre-Organized Triazine Crystals to Nitrogen-Rich Hard Carbons**

*Hui-Ju Kang, Mi Jin Kim, Tae Kyu Lee, \*Young-Si Jun (Chonnam National University, Korea)*

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## TB1 - Artificial Muscles and Electro-Active Polymers II

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October 25 (Thur.), 10:50~12:20, Yang Seungtaik Auditorium, 2F, E9

Session Chair: Takushi Sugino (National Institute of Advanced Industrial Science and Technology, Japan)

**TB1-1 160011 10:50-11:20**

**[Keynote] Combining of Thermodynamic and Cluster-Network Approaches in the Modeling of Ionic Polymer-Metal Composite Actuators**

*Zakai J. Olsen, \*Kwang Jin Kim (University of Nevada, Las Vegas, USA)*

**TB1-2 160045 11:20-11:40**

**[Invited] Printed Haptic Film Actuators for Augmented Surfaces**

*\*Jin Han Jeon, Yong Heng So, Kaushal Sagar (Robert Bosch (SEA) Pte Ltd, Singapore), Fook Tony (Robert Bosch (SEA) Pte Ltd and Nanyang Technological University, Singapore)*

**TB1-3 160069 11:40-12:00**

**PEDOT:PSS-Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene Hybrid as an Antagonistically Functionalized Electrode for High-Performance Ionic Soft Actuator**

*Sima Umrao, Jaehwan Kim, Rassoul Tabassian, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology (KAIST), Korea)*

**TB1-4 160010 12:00-12:20**

**Ionic Polymer Metal-Composite Actuators: Functionality in Catheter Use and Possible Hybridization**

*Justin Neubauer, \*Kwang Jin Kim (University of Nevada, Las Vegas, USA)*

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## TB2 - 3D and 4D Printing I

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October 25 (Thur.), 10:50~12:20, Chung Kunmo Conference Hall, 5F, E9

Session Chair: Joo-Hyung Kim (Inha University, Korea)

**TB2-1 10:50-11:20**

**[Keynote] Metal Additive Manufacturing for Medical Industry**

*\*Chang-Woo Lee, Gun-Hee Kim, Byung-Soo Lee, Hyung-Giun Kim (KITECH, Korea)*

**TB2-2 11:20-11:40**

**Effects of Gait Training with A Body-Powered Exoskeleton on Muscle Material Properties in Paraplegic Patients**

*\*Chang-Yong Ko, Hyuk-Jae Choi, Gyoosuk Kim, Jeicheong Ryu (Rehabilitation Engineering Research Institute, Korea)*



**TB2-3      11:40-12:00**

**The Effect of Laser Power on the Manufacturing of Tibia Baseplate with Porous Structure through Additive Manufacturing Simulation**

*Taeyang Kwak (Sejong University, Korea), Hansol Seo (Samsung medical center, Korea), Jinju Jang, Hunyeong Ban, \*Dohyung Lim (Sejong University, Korea)*

**TB2-4      12:00-12:20**

**Fabrication and Characterization of Bimaterial Self-Deformable Structure using Additive Manufacturing**

*Gwang-Wook Hong, Sun Kon Lee, Sun-Woo Lee, \*Joo-Hyung Kim (Inha University, Korea)*

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## **TB3 - Energy Harvesting and Storage II**

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**October 25 (Thur.), 10:50~12:20, KI Fusion Hall, 1F, E4**

Session Chair: Dukhyun Choi (Kyung Hee University, Korea)

**TB3-1      10:50-11:20**

**[Keynote] Piezoelectric Polymer-Based Roadway Energy Harvesting**

*\*Chong-Yun Kang (Korea Institute of Science and Technology, Korea)*

**TB3-2      11:20-11:40**

**[Invited] Rational Design of Effective Polymer Dielectrics for High-Output Triboelectric Nanogenerator**

*\*Jeong Min Baik (Ulsan National Institute of Science and Technology, Korea)*

**TB3-3      11:40-12:00**

**Electric Potential-Based Sustainable Energy Harvesting Technology and Its Applications**

*\*Sangmin Lee (Chung-Ang University, Korea)*

**TB3-4      12:00-12:20**

**Electrostatic Induction Using Ionic Conductors for Triboelectric Generators**

*Younghoon Lee, \*Jeong-Yun Sun (Seoul National University, Korea)*

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## **Plenary Lecture II**

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**October 25 (Thur.), 13:30~14:30, Yang Seungtaik Auditorium, 2F, E9**

**PL3-1      13:30-14:00**

**[Plenary] Design Considerations for Ultrathin Reflective Membranes for Deep Space Missions**

*\*Robert G. Bryant (NASA Langley Research Center, USA)*

**PL4-1 14:00-14:30****[Plenary] Toward Flexible and Intrinsically Stretchable Electronics***\*Qibing Pei (University of California, Los Angeles, USA)*

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**TC1 - Artificial Muscles and Electro-Active Polymers III**

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**October 25 (Thur.), 14:50~16:30, Yang Seungtaik Auditorium, 2F, E9**

Session Chair: Jin Han Jeon (Robert Bosch (SEA), Singapore)

**TC1-1 14:50-15:20****[Keynote] Electromechanical Modeling of Dielectric Gel Actuators***\*Kinji Asaka (National Institute of Advanced Industrial Science and Technology (AIST), Japan), Minoru Hashimoto (Shinshu University, Japan)***TC1-2 15:20-15:50****[Keynote] Energy Harvesting from Torsional Artificial Muscle***\*Seon Jeong Kim (Hanyang University, Korea)***TC1-3 15:50-16:10****Active Compression Sleeve with Wire-Driven Mechanism for Human Rehabilitation and Assistance***Seungtae Yang, Jaewook Ryu, Doyeon Kim, \*Giuk Lee (Chung-Ang University, Korea)***TC1-4 16:10-16:30****Physics-Based Modeling of Stacked Multi-Layer PVC Gel Actuators***Zachary Frank, Zakai Olsen, \*Kwang Jin Kim (University of Nevada, Las Vegas, USA)*

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**TC2 - 3D and 4D Printing II**

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**October 25 (Thur.), 14:50~16:30, Chung Kunmo Conference Hall, 5F, E9**

Session Chair: Han Sung Kim (Yonsei University, Korea)

**TC2-1 14:50-15:10****[Invited] Practical Printing Applications of Three Modes of Electrohydrodynamic (EHD) Jet***\*Kye Si Kwon, Soobin Oh, Thanh Huy Phung (Soonchunhyang university, Korea)***TC2-2 15:10-15:30****3D Printed Vessel of Dispositive Scaffold for the Tissue Engineered Vascular Graft***Chi Bum Ahn (Gachon University, Korea), Joo Hyun Kim, Tae Ho Kim (GAHIST, Gachon University, Korea), Jin Woo Lee (College of Medicine, Gachon University, Korea), \*Kuk Hui Son (Gachon University Gil Medical Center, Korea)*

**TC2-3 15:30-15:50**

**Workflow Assessing for Predicting the Amount of Joint Power Delivered by the Exoskeleton Equipment with Musculoskeletal Modeling**

*Bokku Kang, Dong-Hyun Hwang, Dong-Hyun Kim, Seo-Hyun Kim, Hana Lee, \*Han Sung Kim (Yonsei University, Korea)*

**TC2-4 15:50-16:10**

**Development of Flexible-Capacitive Pressure Sensor Using Dual 3D Printing**

*Sun Woo Lee, Sun Kon Lee, Hyeong Do Kim, Soon Won Kwon, Hyun Jung Han, Min Seok Choi, \*Jang Woo Kwon (Inha University, Korea)*

**TC2-5 16:10-16:30**

**Development of 3D Printing Process and System for Biomedical Applications**

*Emmanuel Kokloku (Hanbat National University, Korea), Min-Ha Kim (TOPnC Co. Ltd, Korea), \*Dong-Soo Kim (Hanbat National University, Korea)*

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## **TC3 - Energy Harvesting and Storage III**

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**October 25 (Thur.), 14:50~16:10, KI Fusion Hall, 1F, E4**

Session Chair: Tae June Kang (Inha University, Korea)

**TC3-1 14:50-15:10**

**[Invited] Wearable Nanogenerators for Self-Powered Healthcare Applications**

*\*Zong-Hong Lin (National Tsing Hua University, Taiwan)*

**TC3-2 15:10-15:30**

**[Invited] Ultracapacitive Energy Storage Materials and Devices Operating at Extreme Conditions**

*Harpalsinh H. Rana, Jeong Hee Park, Girish S. Gund (Sungkyunkwan University, Korea), Yury Gogotsi (Drexel University, USA), \*Ho Seok Park (Sungkyunkwan University, Korea)*

**TC3-3 15:30-15:50**

**Investigation of Performance Enhancement Using Glass Fabric as Structural Battery Separator**

*Joo-Seung Choi, Jaechan Pyo, Hyun-Wook Park, \*Chun-Gon Kim (Korea Advanced Institute of Science and Technology, Korea)*

**TC3-4 15:50-16:10**

**Electrochemical Performance of MnO<sub>2</sub>@Nitrogen Doped Graphene Oxide/Polypyrrole Nanostructured Electrode Materials for Supercapacitor**

*Sivalingam Ramesh (Dongguk University, Korea), Gwang-Wook Hong (Inha University, Korea), \*Heung Soo Kim (Dongguk University-Seoul, Korea), \*Joo-Hyung Kim (Inha University, Korea)*

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## TD1 - Soft Robotics and Mechatronics III

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October 25 (Thur.), 16:50~18:20, Yang Seungtaik Auditorium, 2F, E9

Session Chair: Kinji Asaka (National Institute of Advanced Industrial Science and Technology, Japan)

### TD1-1 16:50-17:20

#### [Keynote] 3D/4D Manufacturing and Motion Control of Ionic Polymer-Metal Composites for Soft Robotics

James D. Carrico, Tom Tyler (University of Utah, USA), Kwang Jin Kim (University of Nevada Las Vegas, USA), \*Kam K Leang (University of Utah, USA)

### TD1-2 17:20-17:40

#### Pneumatic Tactile Feedback Device Utilizing Electrostatic Force

Kahye Song, \*Youngsu Cha (Korea Institute of Science and Technology, Korea)

### TD1-3 17:40-18:00

#### Preliminary COMSOL Multiphysics based modeling of Coiled Artificial Muscle and the Application of Coiled Artificial Muscle into a Bio-inspired Whale Fin

Robert Hunt, Zakai Olsen, \*Kwang Jin Kim (University of Nevada, Las Vegas, USA)

### TD1-4 18:00-18:20

#### Switching Admittance-Position Control of Soft Exosuits for Walking and Jogging Assistance with Off-Board Actuation

\*Giuk Lee (Chung-Ang University, Korea)

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## TD2 - Space Tech

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October 25 (Thur.), 16:50~18:40, Chung Kunmo Conference Hall, 5F, E9

Session Chair: Joo-Hyung Kim (Inha University, Korea)

### TD2-1 16:50-17:20

#### [Keynote] Smart Optical Materials and Their Prospects

\*Sang H. Choi (NASA Langley Research Center, USA)

### TD2-2 17:20-17:40

#### [Invited] Mechanoluminescence Membrane (ZnS:Cu-PDMS) and Its Application to Basilar Membrane of Artificial Cochlea

\*Gi-Woo Kim (Inha University, Korea)

### TD2-3 17:40-18:00

#### Solarelastic Instability of Heliogyro Solar Sail (INHA-IST session)

\*Jaeyoung Kang (Inha University, Korea), Kwang-Chun Park (University of Colorado, USA)

**TD2-4 18:00-18:20**

**Waste Thermal Energy Harvesting Using Ionic Seebeck Effect**

*Ju Hyeon Kim, Ju Hwan Lee, Jei Gyeong Jeon, \*Tae June Kang (Inha University, Korea)*

**TD2-5 18:20-18:40**

**[Invited] Sustaining Human Presence on Mars Using in Situ Resource Utilization and a Reusable Lander**

*\*Robert W. Moses (NASA Langley Research Center, USA)*

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**TD3 - Energy Harvesting and Storage IV**

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**October 25 (Thur.), 16:50~18:10, KI Fusion Hall, 1F, E4**

Session Chair: Sangmin Lee (Chung-Ang University, Korea)

**TD3-1 16:50-17:10**

**[Invited] Fabrication of n-type Bi<sub>2</sub>Te<sub>3</sub>-based Thermoelectric Materials**

*\*Seung-Hyub Baek (Korea Institute of Science and Technology, Korea)*

**TD3-2 17:10-17:30**

**Thermoelectric Behavior of Flexible Organic Composites with Carbon Nanotubes**

*\*Kyungwho Choi (Korea Railroad Research Institute, Korea)*

**TD3-3 17:30-17:50**

**Discrete Liquid-Solid Contact Electrification and Its Versatile Utilization**

*\*Dongwhi Choi (Kyung Hee University, Korea)*

**TD3-4 17:50-18:10**

**Streaming Potential Based Flexible Fluidic Electricity Generator as Self-Powered Flow Rate Sensor**

*M. Shahriar, \*Kyoung Kwan Ahn (University of Ulsan, Korea)*

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**PS - Poster Session**

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**October 24 (Wed.), 17:30~20:00, Sky Lounge Complex, 5F, E9 Academic Cultural Complex**

**[3D and 4D Printing]**

**PS-1**

**A Direct-writable Catechol-conjugated Chitosan Bioink**

*Daiheon Lee, \*Haeshin Lee (Korea Advanced Institute of Science and Technology, Korea)*

**PS-2**

**A Lifting Assist Device for Low Back Injury Prevention of Industrial Athletes**

*\*Jong-won Lee, Gyoosuk Kim (Korea Workers' Compensation & Welfare Service, Korea)*

**PS-3****Dynamic Performance Studies of 3D Printed Scaffolds for the Artificial Trachea**

*Chi Bum Ahn (Gachon University, Korea), Young Soo Yu, Tae Ho Kim (GAHIST, Gachon University, Korea), Ji-Hyun Lee (Gachon University, Korea), Jae-Ik Lee (Gachon University Gil Medical Center, Korea), Jin Woo Lee (College of Medicine, Gachon University, Korea), \*Kuk Hui Son (Gachon University Gil Medical Center, Korea)*

**PS-4****Analysis of COM Features in Patients with Sarcopenia During Sit-to-Stand**

*\*Yoon-Hee Chang, Chang-Yong Ko, Jung-Sun Kang, Bo-Ra Jeong, Gyu-Seok Kim (Korea Orthopedics and Rehabilitation Engineering Center, Korea)*

**PS-5****Development for Exoskeletal Walking-Assists Robot for Sarcopenia in Elderly**

*SeokJin Hwang, \*GyooSuk Kim (Korea Workers' Compensation & Welfare Service, Korea)*

**PS-6****Development of a Heat Labile Antibiotics Releasing 3D Printed Scaffold for a Treatment of Osteomyelitis**

*Ji-Hyun Lee, Chi Bum Ahn (College of Medicine, Gachon University, Korea), Joo Hyun Kim (Gachon University, Korea), Kuk Hui Son (Gachon University Gil Medical Center, Korea), Eun Seok Choi (Chungnam National University Hospital, Korea), \*Jin Woo Lee (College of Medicine, Gachon University, Korea)*

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*\*Sanghyun Woo (Korea University of Science and Technology, Agency for Defense Development, Korea), Keunho Lee, Yerim Lee (Agency for Defense Development, Korea), Leeju Park (Korea University of Science and Technology, Agency for Defense Development, Korea)*

**PS-8****Effect of Foot Contour of Lower Limb Exoskeleton on Natural Normal Gait Pattern Realization**

*JaeKwan Lee, SeokJu Kim, JiSoo Jeong (Sejong University, Korea), JuWon Ko (Medi-is, Korea), \*Dohyung Lim (Sejong University, Korea)*

**PS-9****Development of Long-term In Vitro  $\beta$ -cells Culture Environment using 3D Bioprinting Technology**

*Chi Bum Ahn, Ji-Hyun Lee (College of Medicine, Gachon University, Korea), Joo Hyun Kim, Tae Ho Kim, Hee-Sook Jun (Gachon University, Korea), Kuk Hui Son (Gachon University Gil Medical Center, Korea), \*Jin Woo Lee (College of Medicine, Gachon University, Korea)*

**PS-10****Comparison of Mechanical Characteristics according to Density of Composite Material Using Dual Nozzle FDM 3D Printing**

*Tae Jung Yoo, Hyeong Do Kim, Yong Rae Kim, Sun Kon Lee, \*Joo-Hyung Kim (Inha University, Korea)*

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*Yong Rae Kim, Hyeong Do Kim, Tae Jung Yoo, Sun Kon Lee, \*Joo-Hyung Kim (Inha University, Korea)*

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**Advanced Electro-Active Dry Adhesive Actuated by an Artificial Muscle Constructed from an Ionic Polymer Metal Composite Reinforced with Nitrogen-doped Carbon Nanocages**

*\*Qingsong He, Xu Yang, Zhongyuan Wang (Nanjing University of Aeronautics & Astronautics, China), Jin Zhao (Nanjing University, China), Min Yu (Nanjing University of Aeronautics & Astronautics, China), Zhen Hu (Nanjing University, China), Zhendong Dai (Nanjing University of Aeronautics & Astronautics, China)*

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*Taehoon Kwon (Korea Institute of Science and Technology, Korea), Youngjong Kang (Hanyang University, Korea), \*Chong Min Koo (Korea Institute of Science and Technology, Korea)*

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**Biomimetic Soft Polymer Actuator based on Polymeric Organic Framework-derived Porous Carbon Nanostructures**

*Jaehwan Kim, Sandipan Roy, Moumita Kotal (Korea Advanced Institute of Science and Technology, Korea), Kwang Jin Kim (University of Nevada, Las Vegas, USA), \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

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*Yunhan Lee, Kiwoo Jun, \*Il-Kwon Oh, \*Haeshin Lee (Korea Advanced Institute of Science and Technology, Korea)*

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*Eui Joong Kim, \*Jong Hun Han (Chonnam National University, Korea)*

**PS-17****Rational Design of Basal Plane Structures of Exfoliated Graphene Oxide via Reactions in Alkaline Solutions**

*Joon Young Cho (University of Science&Technology, Korea Electrotechnology Research Institute, Korea), Won Ki Lee (Korea Institute of Science and Technology, Korea), Soo Yeon Jeong, Jun Yeon Hwang (Korea Electrotechnology Research Institute, Korea), Heon Sang Lee (Dong-A University, Korea), Jong Hwan Park (Korea Electrotechnology Research Institute, Korea), Seung Yol Jeong (University of Science&Technology, Korea Electrotechnology Research Institute, Korea), Hee Jin Jeong, Geon-Woong Lee (Korea Electrotechnology Research Institute, Korea), \*Joong Tark Han (University of Science&Technology, Korea Electrotechnology Research Institute, Korea)*

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*Jung-Hwan Oh, Ji-Seok Kim, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

**PS-19****Biased DC-Switching Technique for Electrochemical Exfoliation Process of Microwave-Assisted Expanded Graphite**

*Sungmook Lim (Chonnam National University, Korea), Jea Uk Lee (Korea Research Institute of Chemical Technology (KRICT), Korea), \*Wonoh Lee (Chonnam National University, Korea)*

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*Se Yeong Jeong, Won Seop Hwang, Jae Yong Cho, Jae Chul Jeong, Jung Hwan Ahn, Seong Do Hong, \*Tae Hyun Sung (Hanyang university, Korea)*

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*Wonjun Jang (Myongji University, Korea), Wook Kim (Kyung Hee University, Korea), Habtamu Gebeyehu Menge (Myongji University, Korea), Dukhyun Choi (Kyung Hee University, Korea), \*Yong Tae Park (Myongji University, Korea)*

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*Kwang-Il Jeong, \*Seong Su Kim (Korea Advanced Institute of Science and Technology, Korea)*

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*GeonMin Park, Yoon Sang Jeong, \*Chong Hyun Lee (Jeju National University, Korea)*



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*Jinhyo Ahn, Hyundu Jin, Chiyong Jo, \*Jongkil Lee (Andong National University, Korea)*

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*Van Hoang Luan, \*Wonoh Lee (Chonnam National University, Korea)*

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*Hee Jae Hwang (Kyung Hee University, Korea), Joo Sung Kim (Hanyang University, Korea), Yeon Seok Jeong, Nghia Dinh Huynh (Kyung Hee University, Korea), Do Hwan Kim (Hanyang University, Korea), \*Dukhyun Choi (Kyung Hee University, Korea)*

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*Wook Kim, Divij Bhatia, Ji-Seop Yu, Hakjeong Kim, \*Dukhyun Choi (Kyung Hee University, Korea)*

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*Saewoong Oh, Seok Hu Bae, Ji Myeong Son, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

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**Self-Reinforced PVDF-HFP Electrolyte Membrane with Nanoparticles Decoration and Lamellar Structural for Advanced Lithium Ion Battery**

*Van-Tien Bui, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

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*Jae Yong Cho, Kyung-Bum Kim, Jung Hwan Ahn, Seong Do Hong, Won Seop Hwang, Se Yeong Jeong, \*Tae Hyun Sung (Hanyang University, Korea)*

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*Yeonhee Kim, \*Youngsu Cha (Korea Institute of Science and Technology, Korea)*

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*Sanghee Nam, Sima Umrao, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

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*Hyun-Jun Kim, Kwan-woo Han, Jae-Eun Kim (Institute for Basic Science (IBS), Korea Advanced Institute of Science and Technology, Korea), Jong-Nam Kim, Jeong-Young Park (Institute for Basic Science (IBS), Korea Advanced Institute of Science and Technology, Korea), \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)*

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*Min Ye Koo (Chonbuk National University, Korea), \*Cheol-Min Yang (Korea Institute of Science and Technology, Korea), Gyo Woo Lee (Chonbuk National University, Korea)*

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*Sunanda Roy, Jae-Hwan Kim, \*Gi-Woo Kim (Inha University, Korea)*

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*\*Junhee Lee, Chang Hoon Bae, Aeri Jang, Hasuk Bae (Ewha Womans University Mokdong Hospital, Korea)*

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*Yu-Jin Park, \*Seung-Bok Choi (Inha University, Korea)*

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*Hyeon Ho Park, Il Jin Kim, Jae Hak Sim, Ji Won Jang, \*Dong Jin Lee (Korea Institute of Footwear and Leather Technology, Korea)*

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*Ji Won Jang, Il Jin Kim, Jae Hak Sim, Hyeon Ho Park, \*Dong Jin Lee (Korea Institute of Footwear and Leather Technology, Korea)*

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*KangGeon Kim, Yonghwan Oh, \*Jaeyoung Park (Korea Institute of Science and Technology, Korea)*

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*Asif Khan, Jae Kyong Shin, \*Heung Soo Kim (Dongguk University, Korea)*

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*Guk-Hwan Lee, Van Hoang Luan, \*Wonoh Lee (Chonnam National University, Korea)*

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*Dong-Hyun Hwang, Seo-Hyun Kim, Hana Lee, Bokku Kang, \*Han Sung Kim (Yonsei University, Korea)*

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*Suman Timilsina, Seong Yeon Ahn, Jun Seop An, \*Ji Sik Kim (Kyungpook National University, Korea)*

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*Min Young Cho, Jun Seop Ahn, \*Ji Sik Kim (Kyungpook National University, Korea)*

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*Carrie Trant, Chulsung Bae, \*Sangwoo Lee (Rensselaer Polytechnic Institute, USA)*

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*YingJun An, \*Hidenori Okuzaki (University of Yamanashi, Japan)*

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*Musashi Briem, Sungmin Park, \*Chulsung Bae, Sangwoo Lee (Rensselaer Polytechnic Institute, USA)*

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*\*Ho-Sang Kim, Won-Gi Lee, Chan-Hee Lee (Institute for Advanced Engineering, Korea), Sang-Jae Yoon, Jin-Kyung Choi (Lacomtech, Korea)*

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#### Development of Soft Wearable Suit to Reduce Medial Patellar Luxation(MPL) for Small Breed Dogs

Chan Beom Park, \*Hyung-Soon Park (Korea Advanced Institute of Science and Technology, Korea)

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Jaeyeon Jeong, Taeyeon Kim, \*Ki-Uk Kyung (Korea Advanced Institute of Science and Technology, Korea)

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Junhee Lee, Chang Hoon Bae, Aeri Jang, \*Hasuk Bae (Ewha Womans University Mokdong Hospital, Korea)

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Jong-Nam Kim, Hyeong-Geon Kim, Jin-Young Jung, \*Il-Kwon Oh (Korea Advanced Institute of Science and Technology, Korea)

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Jaehyun Kim, \*Sung Kyu Park (Chung-Ang University, Korea)

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Jun Ho Lee, Jae Sang Heo (Chung-Ang University, Korea), Ji mi Eom (Sungkyunkwan University, Korea), Jong-Woong Kim (Chonbuk University, Korea), In-Soo Kim (University of Connecticut, USA), Yong-Hoon Kim (Sungkyunkwan University, Korea), \*Sung Kyu Park (Chung-Ang University, Korea)

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Guh-Hwan Lin, Seongwon Woo, Hoyoung Lee (Sungkyunkwan University, Korea), Kyoung-Seok Moon, Hiesang Sohn (Samsung Advanced Institute of Technology (SAIT), Korea), \*Sang-Eui Lee (SAIT, Inha University, Korea), \*Byungkwon Lim (Sungkyunkwan University, Korea)