10th International Conference on Hot Wire (Cat) & Initiated Chemical Vapor Deposition (HWCVD10)

Conference Program

Monday September 3, 2018

09:00-09:10  Welcome Remarks

Plenary  Chair: K.K.S. Lau  Drexel University, USA
09:10-09:50  Mo-PL-1  Current status of Cat-CVD technology
Invited  - history of research and current status of industrial implementation
H. Matsumura
Japan Advanced Institute of Science and Technology (JAIST), Japan

Keynote I  Chair: K.K.S. Lau  Drexel University, USA
09:50-10:30  Mo-KE-1  Hot-wire CVD developments and applications
Invited  L. Schäfer
Fraunhofer Institute for Surface Engineering and Thin Films IST, Germany

10:30-10:50  Coffee break

Special Tutorial  Chair: H. Horibe  Osaka City University, Japan
10:50-11:30  Mo-ST-1  Detection of molecular radical species in catalytic and initiated chemical vapor deposition processes
Invited  H. Umemoto
Shizuoka University, Osaka City University, Japan

11:30-13:00  Lunch

Fundamentals  Chair: K. Ohdaira  Japan Advanced Institute of Science and Technology (JAIST), Japan
13:00-13:40  Mo-O1-1  Modeling of chemical vapor deposition reactions and processes
Invited  M. Kawase
Kyoto University, Japan

13:40-14:00  Mo-O1-2  No shown

14:00-14:20  Mo-O1-3  Decomposition of hexamethyldisilazane on a hot tungsten filament and gas-phase reactions in a hot-wire chemical vapor deposition reactor
E. Ampong, Y. Shi*
*University of Calgary, Canada

14:20-14:40  Mo-O1-4  Surface reactions on the metal catalysts with ethane and four-membered-ring organosilicon molecules
Y. Shi
University of Calgary, Canada

14:40-15:00  Coffee break
### Processes I

**Chair**: A.Y. Kovalgin  
*University of Twente, Netherlands*

**15:00-15:40 Mo-O2-1**  
**Invited**  
**The highs and lows of iCVD**  
K.K.S. Lau  
*Drexel University, USA*

**15:40-16:00 Mo-O2-2**  
**Deposition of polymer films onto moving substrates**  
C. Cheng*, M. Gupta  
*University of Southern California, USA*

**16:00-16:20 Mo-O2-3**  
**Withdrawn**  
*Polymeric thin film fabrication via initiated chemical vapor deposition for protection of optical surfaces*  
M. Ozpirin*, O. Ebil  
*Izmir Institute of Technology, Turkey*

### Applications I

**Chair**: Y. Katamune  
*Kyushu Institute of Technology, Japan*

**16:20-17:00 Mo-O3-1**  
**Invited**  
**Various applications of hot-wire chemical vapor deposition to solar-cell fabrication technologies**  
A. Masuda  
*National Institute of Advanced Industrial Science and Technology (AIST), Japan*

17:30-19:30 **Social**

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**Tuesday September 4, 2018**

### Processes II

**Chair**: Y. Shi  
*University of Calgary, Canada*

**09:00-09:40 Tu-O1-1**  
**Invited**  
**Hotwire-assisted atomic layer deposition: principles and examples**  
A.Y. Kovalgin  
*University of Twente, Netherlands*

**09:40-10:00 Tu-O1-2**  
**Selective coating of nanostructures in normal pressure and temperature based on surface curvature**  
V.A. Lovikka*, M. Leskelä  
*University of Helsinki, Finland*

**10:00-10:20 Tu-O1-3**  
**A simplest Cat-CVD apparatus without direct substrate heating system**  
*Japan Advanced Institute of Science and Technology (JAIST), Japan*

**10:20-10:40 Tu-O1-4**  
**How hot is the wire: optical, electrical and combined methods of filament temperature determination**  
A.J. Onnink*, A.Y. Kovalgin, J. Schmitz  
*University of Twente, Netherlands*

10:40-11:00 **Coffee break**

### Processes III

**Chair**: S. Ohmagari  
*National Institute of Advanced Industrial Science and Technology (AIST), Japan*

**11:00-11:40 Tu-O2-1**  
**Invited**  
**Leading role of HWCVD for diamond and related thin films and coating materials: from advanced instrumentation, industrial applications to future devices**  
R.D. Vispute  
*Blue Wave Semiconductors, Inc., USA*
11:40-12:00  Tu-O2-2  Charge effect on diamond nanoparticles generated in gas phase in hot filament chemical vapor deposition. 
H.Y. Kim*, B.-K. Song, K.-S. Kim, N.-M. Hwang  
*Seoul National University, Korea

Tu-O2-3  Withdrawn

Materials II

12:00-13:40  Lunch

Materials I  Chair: M. Sato  
Kitami Institute of Technology, Japan

13:40-14:20  Tu-O3-1  Invited  Transfer-free 4-inch-scale high-quality monolayer graphene synthesis on Ti-buffered substrates  
*Chungnam National University, Korea

14:20-14:40  Tu-O3-2  Low-temperature formation of nanographene on Cu substrate using pentacene  
A. Heya*, N. Matsuo  
*University of Hyogo, Japan

14:40-15:00  Coffee break

Materials II  Chair: A. Heya  
University of Hyogo, Japan

15:00-15:20  Tu-O4-1  Growth of graphene on non-catalytic substrate by the vapor pressure of catalytic metal  
J. Baek*, J. Kim, J. Kim, T. Suh, B. Shin, S. Jeon  
*Korea Advanced Institute of Science and Technology (KAIST), Korea

15:20-15:40  Tu-O4-2  High quality and monolayer graphene synthesized directly at 150 °C via chemical vapor deposition without transfer process  
B.-J. Park, S.-G. Yoon*  
*Chungnam National University, Korea

15:40-16:00  Tu-O4-3  Synthesis of vertically aligned carbon nanoflakes by hot wire chemical vapor deposition: influence of process pressure and substrate temperature  
M. Singh, H.S. Jha, P. Agarwal*  
*Indian Institute of Technology Guwahati, India

16:00-16:20  Coffee break

16:20-18:00  Poster session

Wednesday September 5, 2018

Materials III  Chair: K. Yasui  
Nagaoka University of Technology, Japan

09:40-10:20  We-O1-1  Invited  Transparent passivated contact and phosphorous catalytic-doping for crystalline silicon solar cells  
*Forschungszentrum Juelich, Germany
We-O1-2  Withdrawn
Effect of filament temperature on optoelectronic properties of hydrogenated microcrystalline silicon thin films deposited by HWCVD
S. Shende, N. Wadibhasme, S.V. Ghaisas, R.O. Dusane
Indian Institute of Technology Bombay, India

We-O1-3  Withdrawn
Hot wire CVD driven silicon nanowire growth below eutectic temperature using Sn nanotemplate
N. Meshram*, A. Kumbhar, R.O. Dusane
*Indian Institute of Technology Bombay, India

10:20-10:40  We-O1-4  Silicon carbide charged nanoparticles generated during a hot filament chemical vapor deposition
D.-Y. Kim*, D. Kim, J.H. Kwon, N.-M. Hwang
*Seoul National University, Korea

10:40-11:00  Coffee break

Materials IV  Chair: S.-G. Yoon
Chungnam National University, Korea
11:00-11:20  We-O2-1  Large reduction of threading dislocation in diamond by hot-filament CVD
National Institute of Advanced Industrial Science and Technology (AIST), Japan

11:20-11:40  We-O2-2  Surface morphology of homoepitaxial diamond grown by hot-filament CVD using organic phosphorus solutions.
Y. Katamune*, D. Arikawa, D. Mori, A. Izumi
*Kyushu Institute of Technology, Japan

11:40-12:00  We-O2-3  Synthesis and characterization of diamond capsules for direct-drive inertial confinement fusion
*Osaka University, Japan

12:00-12:20  We-O2-4  Nitrogen doping of ZnO films using Ir hot-wire in catalytic reaction-assisted CVD
*Nagaoka University of Technology, Japan

12:20-14:00  Lunch

Applications II  Chair: M. Pomaska
Forschungszentrum Juelich, Germaney
14:00-14:20  We-O3-1  Conformal deposition of thin film silicon solar cells with ultrathin photoabsorbers on nanostructured surfaces
R.E.I. Schropp*, L.W. Veldhuizen, Y. Kuang
* University of the Western Cape, South Africa

We-O3-2  Withdrawn
Development of silicon based thin film solar cells using HWCVD on low cost mild steel substrates
N.A. Wadibhasme, P.K. Bijalwan, A. Chikhalkar, M. Agarwal, M. Dutta, R.O. Dusane*
*Indian Institute of Technology Bombay, India
**Applications II**

Chair: M. Pomaska
Forschungszentrum Juelich, Germany

14:20-14:40 We-O4-1 **Conversion of conduction type of Cat-CVD p-type a-Si by ion implantation**
*Japan Advanced Institute of Science and Technology (JAIST), Japan

14:40-15:00 We-O4-2 **Withdrawn**

15:00-15:20 We-O4-3 **Chemical vapor deposition of ultra-thin functional polymer layers for the development of advanced biosensors & microfluidic devices**
C. Neikirk*, Y. Melnik, P. Narwankar
*Applied Materials, USA

16:30- Field trip & Banquet

**Thursday September 6, 2018**

**Keynote II**
Chair: R.E.I. Schropp
University of the Western Cape, South Africa

09:00-09:40 Th-KE-1 **HW/CAT-CVD for high performance crystalline silicon heterojunction solar cells**
Invited Q. Wang
Jinko Solar, China

**Applications IV**
Chair: R.E.I. Schropp
University of the Western Cape, South Africa

10:00-10:20 Th-O1-2 **Annealing behavior of Cat-CVD p-type a-Si for c-Si surface passivation and its superiority over PECVD counterparts**
H.T.C. Tu*, K. Ohdaira, H. Matsumura
*Japan Advanced Institute of Science and Technology (JAIST), Japan

10:20-10:40 Coffee break

**Applications V**
Chair: K. Shimizu
Nihon University, Japan

10:40-11:00 Th-O2-1 **Excellent passivation quality of MPAT crystalline silicon textures for solar cells by using proper chemical cleaning and Cat-CVD SiNx/a-Si stacked layers**
C.T. Nguyen*, K. Ohdaira, H. Matsumura
*Japan Advanced Institute of Science and Technology (JAIST), Japan

11:00-11:20 Th-O2-2 **Improvement in the passivation quality of Cat-CVD SiNx films on crystalline Si at room temperature**
J. Miyaura, K. Ohdaira*
*Japan Advanced Institute of Science and Technology (JAIST), Japan
11:20-11:40    Th-O2-3  Tunnel oxide passivated contact for crystalline silicon solar cells using hot-wire chemical vapor deposition
*Forschungszentrum Jülich, Germany

11:40-12:00  Closing Remarks
Oxygen additive effects on decomposition rate of poly(vinyl phenol)-based polymers using hydrogen radicals produced by a tungsten hot-wire catalyst
M. Yamamoto*, S. Nagaoka, K. Ohdaira, H. Umemoto, H. Horibe
*National Institute of Technology, Kagawa College, Japan

Removal of carbon contamination on easily-oxidizable-metal coated mirrors for synchrotron radiation beamline using atomic hydrogen
M. Niibe*, T. Harada, A. Heya, T. Watanabe, N. Matsuo
*University of Hyogo, Japan

Role of chamber pressure on crystallinity and composition of silicon films using silane and methane as precursors in HWCVD technique
R. Madaka, J. Kumari, V. Kanneboina, H.S. Jha, P. Agarwal*
*Indian Institute of Technology Guwahati, India

In situ cleaning of silicon substrate by atomic hydrogen and argon and its application for solar cells
Y. Someya*, K. Shimizu
*Nihon University, Japan

Passivation of crystalline silicon surfaces with a few µm-sized pyramids by Cat-CVD silicon nitride films
J. Liu, Y. Wen*, N. Ooyagi, Y. Yamamoto, K. Ohdaira
*Japan Advanced Institute of Science and Technology (JAIST), Japan

Influence of ITO sputtering on the performance of silicon heterojunction solar cells with Cat-CVD amorphous silicon films
T. Konishi, K. Ohdaira*
*Japan Advanced Institute of Science and Technology (JAIST), Japan

Large area HWCVD processes for Si heterojunction solar cells
O. Astakhov, M. Justianto, T. Harig, M. Höfer, V. Sittinger, K. Ding*
*Forschungszentrum Jülich GmbH, Germany

HWCVD for silicon photonics: a new industrial application
*University of Southampton, UK

Growth of highly nanocrystalline cubic silicon carbide (3C-SiC) thin films prepared by hot wire chemical vapor deposition technique
H.S. Jha*, P. Agarwal
*Indian Institute of Technology Guwahati, India, Gifu University, Japan

Substrate temperature dependence of SiO₂ layer formed on Si(100) by H₂O/H₂ decomposed species
S. Tahara*, K. Fukushima, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan
TuP-11  Evaluation of composition and electrical characteristics of SiOCN thin films deposited by HWCVD
M. Matsumoto*, H. Tsutsui, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

TuP-12  Evaluation of corrosion resistance of SiOCN film by HWCVD method
K. Fukushima*, S. Tahara, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

TuP-13  Cu diffusion properties of SiCN films deposited by hot-wire chemical vapor deposition
H. Tsutsui*, S. Hayashida, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

TuP-14  Preparation of ZrO$_x$N$_y$ film at low temperatures by reactive sputtering assisted by hot-wire
M. Sato*, H. Kitada, M.B. Takeyama
*Kitami Institute of Technology, Japan

TuP-15  Hot-wire hydrogenation for In-Sn-Zn-O and improvement of the TFT reliability
T. Yanagisawa*, Y. Someya, K. Shimizu
*Nihon University, Japan

TuP-16  Investigation of diamond growth on SiCN films deposited by hot wire CVD
F. Morishita*, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

TuP-17  Micro-sized diamond growth using organic phosphorus solution by hot filament chemical vapor deposition
D. Arikawa*, D. Mori, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

TuP-18  Structural evaluation of polycrystalline diamond films grown by hot filament CVD using organic phosphorus solutions
D. Mori*, D. Arikawa, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

TuP-19  Thermally stable diamond resisiters fabricated by hot-filament CVD accompanying metal masks
S. Suzuki*, S. Ohmagari, H. Kawashima, H. Umezawa
*National Institute of Advanced Industrial Science and Technology (AIST), Japan

TuP-20  Change in optical transmittance of carbon nanowall by oxygen plasma treatment
*Gifu University, Japan

TuP-21  Investigation for large area deposition of carbon nanowall by hot-wire chemical vapor deposition
*Gifu University, Japan

TuP-22  Semiconducting properties of nitrogen doped-graphene by in-situ synthesis at 150 °C
Y.-Han*, B.-J. Park, M.-W. Nam, S.-G. Yoon
*Chungnam National University, Korea