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 Invited
Current status of Cat-CVD technology
- 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 Invited
Hot-wire CVD developments and applications
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 Invited
Detection of molecular radical species in catalytic and initiated chemical vapor deposition processes
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 Invited
Modeling of chemical vapor deposition reactions and processes
M. Kawase
Kyoto University, Japan

13:40-14:00 Mo-O1-2 No shown
~~**A computational model for n-butyl acrylate film deposition in initiated chemical vapor deposition process**~~
~~S. Ates*, O. Ebil~~
~~*Izmir Institute of Technology, Turkey~~

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16:00-16:20 Mo-O2-3 Withdrawn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**

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
H. Matsumura*, K. Koyama, K. Ogawa, S. Terashima, T. Konishi, T. Baba, Y. Takeuchi, K. Ohdaira
*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
~~**Hot wire chemical vapour deposition aided growth of nano graphene at low substrate temperature**~~
~~S. Ramakrishna, R.O. Dusane*~~
~~*Indian Institute of Technology Bombay, India~~

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**
B.-J. Park, J.-S. Choi, H. Ha, H.Y. Kim, K.-S. Kim, Z. Lee, G. Park, H.-T. Jung, J.-H. Eom, S.-G. Yoon*
*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**
M. Pomaska*, Y. Liu, F. Komoll, A. Lambertz, W. Duan, H. Li, D. Qiu, M. Köhler, F. Finger, U. Rau, K. Ding
*Forschungszentrum Juelich, Germaney

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**

S. Ohmagari, H. Yamada, S. Tanaka, N. Tsubouchi, H. Umezawa, A. Chayahara, Y. Mokuno

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**

H. Kato*, H. Yamada, S. Ohmagari, A. Chayahara, Y. Mokuno, Y. Fukuyama, N. Fujiwara, K. Miyanishi, Y. Hironaka, K. Shigemori

*Osaka University, Japan

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

Y. Adachi, S. Ono, A. Kato, A.M. Hashim, K. Yasui*

*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 III Chair : M. Pomaska
Forschungszentrum Juelich, Germaney

14:20-14:40 We-O4-1 **Conversion of conduction type of Cat-CVD p-type a-Si by ion implantation**
H.T.C. Tu*, K. Koyama, N. Yamaguchi, H. Suzuki, K. Ohdaira, H. Matsumura
*Japan Advanced Institute of Science and Technology (JAIST), Japan

14:40-15:00 We-O4-2 Withdrawn
~~**A novel processing method to pattern hot wire chemical deposited a-Si:H for application in pressure sensing device**~~
~~V. Pandey*, M.P. Gururajan, R.O. Dusane~~
~~*Indian Institute of Technology Bombay, Ujjain Engineering College, India~~

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 Invited **HW/CAT-CVD for high performance crystalline silicon heterojunction solar cells**
Q. Wang
Jinko Solar, China

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

Th-O1-1 Withdrawn
~~**Optimization of boron doped hydrogenated amorphous Si layers prepared by hot-wire CVD technique for n type crystalline Si hetero-junction solar cells**~~
~~A. Mandal, N. Wadibhasme, A. Kumbhar, S.V. Ghaisas, R.O. Dusane*~~
~~*Indian Institute of Technology Bombay, India~~

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 SiN_x/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 SiN_x 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**

S. Li*, M. Pomaska, J. Hoß, W. Wang, J. Lossen, F. Pennartz, M. Nuys, F. Finger, U. Rau, K. Ding
*Forschungszentrum Jülich, Germaney

11:40-12:00 Closing Remarks

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

Poster session

Tuesday September 4, 2018 16:20-18:00

Tu-P-01 **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

Tu-P-02 **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

Tu-P-03 **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

Tu-P-04 **In situ cleaning of silicon substrate by atomic hydrogen and argon and its application for solar cells**
Y. Someya*, K. Shimizu
*Nihon University, Japan

Tu-P-05 **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

Tu-P-06 **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

Tu-P-07 **Large area HWCVD processes for Si heterojunction solar cells**
O. Astakhov, M. Justianto, T. Harig, M. Höfer, V. Sittinger, K. Ding*
*Forschungszentrum Jülich GmbH, Germaney

Tu-P-08 **HWCVD for silicon photonics: a new industrial application**
A. Tarazona*, S.Z. Oo, T.D. Bucio, R. Petra, A.Z. Khokhar, V. Mittal, F.Y. Gardes, G.T. Reed, H.M.H. Chong
*University of Southampton, UK

Tu-P-09 **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

Tu-P-10 **Substrate temperature dependence of SiO_2 layer formed on Si(100) by H_2O/H_2 decomposed species**
S. Tahara*, K. Fukushima, Y. Katamune, A. Izumi
*Kyushu Institute of Technology, Japan

Tu-P-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

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

Tu-P-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

Tu-P-14 **Preparation of ZrO_xN_y film at low temperatures by reactive sputtering assisted by hot-wire**
M. Sato*, H. Kitada, M.B. Takeyama
*Kitami Institute of Technology, Japan

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

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

Tu-P-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

Tu-P-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

Tu-P-19 **Thermally stable diamond resistors 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

Tu-P-20 **Change in optical transmittance of carbon nanowall by oxygen plasma treatment**
K. Tanabe*, H. Yamamoto, Y. Ieda, S. Hanada, S. Yamada, T. Itoh, S. Nonomura
*Gifu University, Japan

Tu-P-21 **Investigation for large area deposition of carbon nanowall by hot-wire chemical vapor deposition**
T. Itoh*, H. Sobue, K. Hayashi, S. Hanada, H. Yamamoto, S. Yamada, S. Nonomura
*Gifu University, Japan

Tu-P-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