

2016 29th International Vacuum Nanoelectronics Conference (IVNC 2016)

**Vancouver, British Columbia, Canada
11-15 July 2016**



**IEEE Catalog Number: CFP16VAC-POD
ISBN: 978-1-5090-2420-9**

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

******This publication is a representation of what appears in the IEEE Digital Libraries. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16VAC-POD
ISBN (Print-On-Demand):	978-1-5090-2420-9
ISBN (Online):	978-1-5090-2419-3
ISSN:	2164-2370

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

MONDAY, 11 JULY 2016

08:00-10:00 Registration

10:00-10:30 Breakfast and welcome address

10:30-12:00 Tutorial 1: theory and modeling of field-electron emitters

- 10:30 Tutorial T1.1 (35+10 min): Field electron emission theory for metals and semiconductors N/A

R. G. Forbes

University of Surrey, UK

- 11:15 Tutorial T1.2 (35+10 min): Atomic-level modeling of cold field electron emission, using carbon as an example N/A

Z. Li

Sun Yat-sen University, China

12:00-14:00 Lunch and networking

14:00-15:30 Tutorial 2: theory and modeling of photo-electron emitters

- 14:00 Tutorial T2.1 (35+10 min): An introduction to photoemission: theory and modeling N/A

K. L. Jensen

Naval Research Laboratory, USA

- 14:45 Tutorial T2.2 (35+10 min): Photoemission of electrons from sharp needle tips driven by femtosecond laser pulses: a tutorial N/A

P. Hommelhoff

Friedrich-Alexander University Erlangen-Nuremberg, Germany

15:30-16:00 Coffee break

16:00-17:30 Tutorial 3: theory and modeling of thermal electron emitters

- 16:00 Tutorial T3.1 (35+10 min): Thermionic emission theory: a tutorial N/A

T. R. Groves

University at Albany, State University of New York, USA

- 16:45 Tutorial T3.2 (35+10 min): Thermionic emission for novel materials and its thermal relevance on other emission mechanisms N/A

L. K. Ang

Singapore University of Technology and Design, Singapore

17:30-18:00 Free time

18:00-19:30 Welcome reception

08:00-08:30 Breakfast and registration

08:30-10:15 Photo-emission 1: ultra-fast emitters

- 08:30 Plenary PE1.P1 (35+10 min): Harnessing photoionization or photo-recombination to create attosecond science and technology N/A

P. B. Corkum

University of Ottawa and National Research Council, Canada

- 09:15 PE1.C1 (15+5 min): An exact formulation for ultrafast electron emission due to a DC bias and a laser field 1

P. Zhang, Y. Y. Lau

University of Michigan, USA

- 09:35 PE1.C2 (15+5 min): Electron emission from nanostructures triggered by optical and terahertz ultrafast pulses 3

M. Monshipouri, Y. Abdi, Y. Oh, S. Bagiante, V. Guzenko, S. Tsujino, F. Brunner, T. Feurer

University of Tehran, Iran; Paul Scherrer Institute, Switzerland; University of Bern, Switzerland

- 09:55 PE1.C3 (15+5 min): Field emission from gated silicon field emitter array induced by sub-nanosecond laser pulses 5

H. Shimawaki, Y. Neo, H. Mimura, M. Nagao, F. Wakaya, M. Takai

Hachinohe Institute of Technology, Japan; Shizuoka University, Japan; National Institute of Advanced Industrial Science and Technology, Japan; Osaka University, Japan

10:15-10:30 Coffee break

10:30-11:50 Photo-emission 2: properties and applications

- 10:30 PE2.C1 (15+5 min): Photo-enhanced field emission properties of p-doped black Si arrays 7

S. Mingels, V. Porshyn, P. Serbun, D. Lützenkirchen-Hecht, G. Müller, C. Prommesberger, C. Langer, R. Schreiner

University of Wuppertal, Germany; OTH Regensburg, Germany

- 10:50 PE2.C2 (15+5 min): Delayed photo-emission model for PIC codes N/A

K. L. Jensen, J. J. Petillo, D. Panagos, S. Ovtchinnikov, N. A. Moody

Naval Research Laboratory, USA; Leidos Corp., USA; Gnosys, Inc., USA; Los Alamos National Laboratory, USA

- 11:10 PE2.C3 (15+5 min): A bright and durable field-emission source derived from frozen refractory-metal Taylor cones 9

G. Hirsch

Hirsch Scientific, USA

- 11:30 PE2.C4 (15+5 min): Radiation tolerance of compact image sensor with field emitter array and cadmium telluride-based photoconductor 11

Y. Gotoh, H. Tsuji, M. Nagao, T. Masuzawa, Y. Neo, H. Mimura, T. Okamoto, M. Akiyoshi, N. Sato, I. Takagi

Kyoto University, Japan; National Institute of Advanced Industrial Science and Technology, Japan; Shizuoka University, Japan; National Institute of Technology, Japan; Osaka Prefecture University, Japan

11:50-16:30 Lunch and tour 1

16:30-18:00 Rapid fire posters overview and poster session 1

08:00-08:30 Breakfast and registration

08:30-10:15 Field-emission 1: vacuum nanoelectronic devices

- 08:30 Plenary FE1.P1 (35+10 min): Nanoscale vacuum electronic devices N/A
M. Meyyappan
NASA Ames Research Center, USA
- 09:15 FE1.C1 (15+5 min): The enhancement of the electron field emission behavior of diamond/CNTs materials via the plasma post-treatment process for the applications in triode-type vacuum field emission transistor 13
D. Manoharan, H.-T. Chang, I.-N. Lin, T.-H. Chang, P.-Y. Hsieh, S. Kunuku, K.-C. Leou, C.-Y. Lee, N.-H. Tai,
Tamkang University, Taiwan; NTHU, Taiwan
- 09:35 FE1.C2 (15+5 min): Graphene-based micro-emitters and vacuum transistors 15
G. Wu, X. Wei
Peking University, China
- 09:55 FE1.C3 (15+5 min): Planar graphene vacuum transistor performance potential 17
J. L. Shaw, J. G. Champlain, B.-D. Kong, K. L. Jensen, J. B. Boos
Naval Research Laboratory, USA

10:15-10:30 Coffee break

10:30-12:00 Field-emission 2: novel nanoscale emitters

- 10:30 Invited FE2.I1 (20+10 min): Application of ultra-high-brightness nano-emitter for electron microscopes N/A
H. Zhang, J. Tang, Y. Yamauchi, L.-C. Qin
National Institute for Materials Science, Japan; University of North Carolina Chapel Hill, USA
- 11:00 FE2.C1 (15+5 min): Fabrication of transparent gated ZnO nanowire field emitter arrays 19
G. Zhang, Z. Zhang, L. Zhao, J. She, S. Deng, N. Xu, J. Chen
Sun Yat-sen University, China
- 11:20 FE2.C2 (15+5 min): Field electron emission of boron nitride nanotube emitters 21
K. N. Yun, G. Leti, J. S. Han, C. J. Lee, Y.-H. Song
Korea University, Korea; ETRI, Korea
- 11:40 FE2.C3 (15+5 min): Single SnO₂ nanowire: field emission investigations 23
P. D. Joshi, D. S. Joag, I. S. Mulla, D. J. Late
Savitribai Phule Pune University, India; Centre for Materials for Electronics Technology, India; CSIR-National Chemical Laboratory, India

12:00-14:00 Rapid fire posters overview, lunch and poster session 2

14:00-15:30 Field-emission 3: nano-carbon emitters

- 14:00 Invited FE3.I1 (20+10 min): Circular gated carbon nanotube field emitters with ballasted resistance N/A
J. T. W. Yeow
University of Waterloo, Canada
- 14:30 FE3.C1 (15+5 min): A platform to optimize the field emission properties of carbon-nanotube-based fibers 25
M. Cahay, W. Zhu, K. L. Jensen, R. G. Forbes, S. B. Fairchild, T. C. Back, G. Gruen, T. Murray, J. R. Harris, D. A. Shiffler
University of Cincinnati, USA; Naval Research Laboratory, USA; University of Surrey, UK; Air Force Research Laboratory, USA; University of Dayton, USA
- 14:50 FE3.C2 (15+5 min): Unprecedented current modulation with in-plane gated field emitters 27
L. Sabaut, P. Ponard, J.-P. Mazellier, P. Legagneux
Thales Electron Devices, France; Thales Research and Technology, France
- 15:10 FE3.C3 (15+5 min): In situ field emission measurement and field emission enhancement of few-layer graphene decorated with Au nanoparticles 29
J. Xu, Q. Wang, Z. Qi, Y. Zhai, X. Zhang
Southeast University, China

15:30-16:00 Coffee break

16:00-17:30 Field-emission 4: non-vacuum devices and vacuum generation

- 16:00 Invited FE4.I1 (20+10 min): On the role of field emission in atmospheric-pressure microscale plasmas N/A
D. B. Go
University of Notre Dame, USA
- 16:30 FE4.C1 (15+5 min): Ultra-low turn-on field emission devices characterized at atmospheric pressures and high temperatures 31
W. M. Jones, D. Lukin, A. Scherer
California Institute of Technology, USA
- 16:50 FE4.C2 (15+5 min): He channel nanotransistors – Towards “vacuum-less” empty state electronics 33
S. A. Guerrero, A. I. Akinwande
Creative Microsystems, Inc., USA; Massachusetts Institute of Technology, USA
- 17:10 FE4.C3 (15+5 min): Improved ionization efficiency in MEMS-type ion-sorption micropump 35
T. Grzebyk, A. Górecka-Drzazga, J. A. Dziuban
Wrocław University of Science and Technology, Poland

08:00-08:30 Breakfast and registration

08:30-10:25 Thermal emission and energy conversion

- 08:30 Plenary TEC.P1 (35+10 min): Thermoelectronic energy conversion - A large-scale nano-application? N/A
J. Mannhart, R. Wanke, I. Rastegar, W. Voesch, W. Braun
Max Planck Institute for Solid State Research, Germany
- 09:15 Invited TEC.I1 (20+10 min): Wafer-scale thermionic energy converters N/A
R. T. Howe
Stanford University, USA
- 09:45 TEC.C1 (15+5 min): The state and potential of diamond in efficient direct energy conversion 37
F. A. Koeck, R. J. Nemanich
Arizona State University, USA
- 10:05 TEC.C2 (15+5 min): Towards compact solar thermionic converters based on carbon nanotubes forests 39
K. Dridi, A. H. Khoshaman, A. Nojeh, G. A. Sawatzky
University of British Columbia, Canada

10:25-10:30 Coffee break

10:30-12:00 Materials and devices 1: fabrication and characterization

- 10:30 Invited MD1.I1 (20+10 min): The applications of super-aligned carbon nanotubes in vacuum electronics N/A
P. Liu, Y. Wei, L. Liu, S. Fan, K. Jiang
Tsinghua University, China
- 11:00 MD1.C1 (15+5 min): Vertically aligned carbon nanotubes (VACNTs) size shrinking through catalyst size reduction: use of innovative nanodiamonds hard mask technique 41
J.-P. Mazellier, J. Delchevalrie, L. Sabaut, H. Girard, S. Saada
Thales Research and Technology, France; Thales Electron Devices, France; CEA-LIST LCD, France
- 11:20 MD1.C2 (15+5 min): Self-aligned double patterning for vacuum electronic device fabrication 43
A. T. Koch, A. R. Lingley, M. N. Mankin, T. S. Pan
Modern Electron, USA
- 11:40 MD1.C3 (15+5 min): Electron emission properties of graphene-oxide-semiconductor planar-type electron emission devices 45
K. Murakami, M. Nagao, S. Tanaka, T. Iijima, J. Fujita, Y. Nemoto, M. Takeguchi
AIST, Japan; University of Tsukuba, Japan; NIMS, Japan

12:00-16:30 Lunch and tour 2

16:30-17:30 Free time

17:30-18:00 Group photo

18:00-21:00 Banquet

FRIDAY, 15 JULY 2016

08:00-08:30 Breakfast and registration

08:30-10:25 Materials and devices 2: microscopy

- 08:30 Plenary MD2.P1 (35+10 min): With new electron optical concepts towards the most advanced electron microscopes N/A
M. Haider
CEOS GmbH, Germany; Karlsruhe Institute of Technology, Germany
- 09:15 Invited MD2.I1 (20+10 min): Using ultra-bright electron sources to analyze matter atom-by-atom N/A
O. L. Krivanek, N. J. Bacon, N. Dellby, T. C. Lovejoy
Nion Co., USA; Arizona State University, USA
- 09:45 MD2.C1 (15+5 min): Development of small sized FE-SEM equipped with a carbon nanotube field emitter 47
Y. Saito, S. Oishi, S. Yamazaki, H. Nakahara, H. Murata, T. Ohno
Nagoya University, Japan; Meijo University, Japan; Technex Lab Co., Japan
- 10:05 MD2.C2 (15+5 min): Field emission microscopy study of freestanding carbon nanotube array 49
Y. Sun, Y. Li, J. T.W. Yeow
University of Waterloo, Canada

10:25-10:40 Coffee break

10:40-12:20 Materials and devices 3: microscopy

- 10:40 Invited MD3.I1 (20+10 min): The current state-of-the-art in electron imaging and spectroscopy of materials N/A
D. J. Baek, R. Hovden, B. H. Savitzky, I. El Baggari, P. Liu, S. H. Sung, L. F. Kourkoutis
Cornell University, USA
- 11:10 Invited MD3.I2 (20+10 min): Quantum electron microscopy N/A
K. K. Berggren, N. Abedzadeh, A. Agarwal, C.-S. Kim, R. Hobbs, P. Kruit, Y. Yang
Massachusetts Institute of Technology, USA; Delft University of Technology, Netherlands
- 11:40 MD3.C1 (15+5 min): Electron emission microscopy of scandate cathode emission sites 51
I. Brodie, B. Vancil
E beam, Inc., USA
- 12:00 MD3.C2 (15+5 min): Low energy electron microscopy study of directionally solidified LaB₆-(Zr, V)B₂ eutectics 53
T. C. Back, S. B. Fairchild, P. Soukiasian, M.-H. Berger, D. Martinotti, L. Douillard, M. Kordes, G. Gruen, P. T. Murray, A. K. Schmid, G. Chen, A. Sayir
University of Dayton, USA; Air Force Research Laboratory, USA; Commissariat à l'Energie Atomique, France; Université de ParisSud/Orsay, France; Ecole des Mines de Paris, France; Ohio University, USA; Lawrence Berkeley National Laboratory, USA; NASA Glenn Research Center, USA

12:20-14:00 Rapid fire posters overview, lunch and poster session 3

14:00-15:20 Field-emission 5: properties and applications

- 14:00 FE5.C1 (15+5 min): Developing field emission electron sources based on ultrananocrystalline diamond for accelerators 55
S. V. Baryshev, C. Jing, J. Qiu, S. Antipov, V. Jabotinski, J. Shao, W. Gai, A. V. Sumant
Euclid TechLabs LLC, USA; Argonne National Laboratory, USA
- 14:20 FE5.C2 (15+5 min): Intrinsic emittance and coherence of double-gate field emitter arrays 57
S. Tsujino, P. Das Kanungo, M. Monshipouri, C. Lee, T. Yamada, G. Kassier, R. J. D. Miller
Paul Scherrer Institute, Switzerland; National Institute of Advanced Industrial Science and Technology, Japan; Max Planck Institute for the structure and Dynamics of Matter, Germany
- 14:40 FE5.C3 (15+5 min): A high-performance carbon nanotube-based field emission x-ray tube for commercial dental imaging 59
S. Park, J.-W. Jeong, J.-W. Kim, J.-T. Kang, J.-H. Yeon, M.-S. Shin, S. Kim, E. Go, H. Jeon, Y. C. Choi, Y.-H. Song
ETRI, Korea; UST, Korea
- 15:00 FE5.C4 (15+5 min): Extraction of the characteristics of limiting elements from field emission measurement data 61
M. Bachmann, F. Dams, F. Düsberg, M. Hofmann, A. Pahlke, C. Langer, R. Lawrowski, C. Prommesberger, R. Schreiner
Ketek GmbH, Germany; OTH Regensburg, Germany

15:20-15:40 Coffee break

15:40-17:00 Field-emission 6: novel nanoscale emitters

- 15:40 FE6.C1 (15+5 min): Spin polarization of electrons field-emitted from Cr thin film deposited on W<001> tips 63
S. Nagai, N. Sakai, K. Miyazaki, H. Toyama, T. Iwata, K. Kajiwara, K. Hata
Mie University, Japan
- 16:00 FE6.C2 (15+5 min): An electron source possessing spatial and temporal coherence: A niobium nanoemitter 65
W.-T. Chang, J.-L. Hou, C.-C. Shih, Y.-F. Yu, T.-Y. Fu, I.-S. Hwang
Academia Sinica, Taiwan
- 16:20 FE6.C3 (15+5 min): Field emission from three-dimensional epitaxial grown GaN-microrods 67
R. Lawrowski, C. Langer, C. Prommesberger, R. Schreiner
OTH Regensburg, Germany
- 16:40 FE6.C4 (15+5 min): In-situ study of surface work function, electrical characteristic and field emission property of individual ZnO nanowire 69
Y. Chen, X. Song, Z. Li, J. She, S. Deng, N. Xu, J. Chen
Sun Yat-sen University, China

POSTER SESSION 1

- P1.1. High current density MEMS deuterium ionizers 71
M. Araghchini, S. A. Guerrero, A. I. Akinwande
Massachusetts Institute of Technology, USA
- P1.2. Secondary electron emission from novel gate in x-ray tube 73
L. Yuan, Z. Zhuoya, L. Wei, Z. Xiaobing, C. Shengcheng, Y. Hua
Southeast University, China
- P1.3. X-ray phase contrast imaging using a micro-focused electron source 75
C. Shengcheng, Z. Zhuoya, L. Wei, Z. Xiaobing, L. Yuan, Y. Hua
Southeast University, China
- P1.4. Field emission characteristics of carbon nanotube cold cathode by driving millisecond width pulse voltage 77
Y. Tan, W. Zhu, Y. Zhang, J. Chen, N. Xu, S. Deng
Sun Yat-sen University, China
- P1.5. Carrier concentration-dependence of cooling of field emission from n-type semiconductor cathodes 79
M. S. Chung, J. Y. Choi, N. M. Miskovsky, P. H. Cutler
University of Ulsan, Korea; Pennsylvania State University, USA
- P1.6. Tip-geometry enhanced cooling of field emission from semiconductor cathodes 81
J. Y. Choi, B.-G. Yoon, M. S. Chung
University of Ulsan, Korea
- P1.7. Carbon nanotube fiber array field emission cathodes N/A
S. B. Fairchild, D. Marincel, T. C. Back
Air Force Research Laboratory, USA; Rice University, USA; University of Dayton, USA
- P1.8. A new analysis of kinked current-voltage-type plots in Lauritsen's 1929 PhD thesis, and some modern implications N/A
R. G. Forbes
University of Surrey, UK
- P1.9. Comparisons between apex-radius values extracted from Fowler-Nordheim plots and from SEM measurements, for carbon-based field emitters N/A
R. G. Forbes, A. A. Al-Qudah, S. Alnawasreh, M. A. Madanat, M. S. Mousa
University of Surrey, UK; Mu'tah University, Jordan
- P1.10. Notes on the format of Fowler-Nordheim-type equations N/A
R. G. Forbes
University of Surrey, UK
- P1.11. On the physical electrostatics of finite field emitter arrays N/A
R. G. Forbes
University of Surrey, UK
- P1.12. Testing Fowler-Nordheim-type equations N/A
R. G. Forbes, J. H.B Deane
University of Surrey, UK
- P1.13. Electrical properties of Cs₃Sb photocathode emitters in panel device applications N/A
H.-S. Jeong, K. Keller, B. Culkin
University of Suwon, Korea; Photegra Corporation, USA
- P1.14. Fabrication of flat-panel lighting devices utilizing cesium antimonide photocathodes as flat electron emitters N/A
H.-S. Jeong, K. Keller, B. Culkin
University of Suwon, Korea; Photegra Corporation, USA
- P1.15. Fabrication of microplasma devices utilizing various diamond films and CNT/diamond heterostructured films as cathodes N/A
D. Manoharan, I-N. Lin, Loganathan
Tamkang University, Taiwan; National Tsing Hua University, Taiwan

POSTER SESSION 1 (continued)

- P1.16. Development of CdTe based photoconductive target for radiation tolerant compact image sensors 83
T. Masuzawa, Y. Neo, H. Mimura, T. Okamoto, M. Nagao, Y. Gotoh, M. Akiyoshi, N. Sato, I. Takagi
Shizuoka University, Japan; National Institute of Technology, Japan; National Institute of Advanced Industrial Science and Technology, Japan; Kyoto University, Japan; Osaka Prefecture University, Japan
- P1.17. Permeation of electron beam through graphene 85
T. Masuzawa, Y. Neo, H. Mimura, T. Yamada
Shizuoka University, Japan; National Institute of Advanced Industrial Science and Technology, Japan
- P1.18. Cascade luminescence as a way to increase the energy efficiency of cathodoluminophores 87
D. I. Ozol
Moscow Institute of Physics and Technology, Russia
- P1.19. Preliminary study of cathode ray tube phosphores on the basis of nanocrystal quantum dots 89
D. I. Ozol
Moscow Institute of Physics and Technology, Russia
- P1.20. Cold field emission from a low-dimensional paraboloidal tip 91
A. A. Patterson, A. I. Akinwande
Massachusetts Institute of Technology, USA
- P1.21. New phenomenological model of the so-called “low voltage” field emission 93
V. E. Ptitsin
Russian Academy of Sciences, Russia
- P1.22. Physical and numerical modeling of the stand-alone nanoscale electrical energy generator operating on the bases of abnormal thermal field emission phenomenon at room temperature 95
V. E. Ptitsin
Russian Academy of Sciences, Russia
- P1.23. Resonant tunneling behavior in ion-enhanced field and thermo-field emission 97
X. Tan, N. Griggs, P. Rumbach, D. B. Go, K. L. Jensen
University of Notre Dame, USA; Naval Research Laboratory, USA
- P1.24. The role of carbon nanotube forest density in thermionic emission 99
K. Voon, K. Dridi, M. Chowdhury, M. Chang, A. Nojeh
University of British Columbia, Canada
- P1.25. Theoretical and experimental study of characteristics of the planar tetrode with field emission of diamond-like carbon film 101
N.P. Aban'shin, A.P. Loginov, D.S. Mosiyash, A.N. Yakunin
Volga-Svet Co. Ltd., Russia; Russian Academy of Sciences, Russia
- P1.26. Theoretical research on an 8mm traveling wave tube based on carbon nanotube cold cathode 103
Z. Yuan, X. Yuan, S. Guo, Y. Yan, Y. Zhang, S. Deng
University of Electronic Science and Technology of China, China; Sun Yat-Sen University, China
- P1.27. Enhancement of interfacial adhesion between carbon nanotube thin film and substrate using a gold-nickel buffer layer 105
Q. Liang, Y. Zhang, Y. Ke, J. Chen, N. Xu, S. Deng
Sun Yat-Sen University, China
- P1.28. Field emission from graphene sheets grown by RF-PECVD method N/A
N. Zhao, J. Chen, K. Qu, Z. Zhao, W. Lei, X. Zhang
Southeast University, China; Nanjing University of Posts and Telecommunications, China

POSTER SESSION 2

- P2.1. Fabrication of single-atom electron sources by use of surface diffusion method 107
H. Asai, S. Kumagai, H. Murata, E. Rokuta, C. Oshima
Meijo University, Japan; Waseda University, Japan
- P2.2. Emission from in-situ Ba-coated nanocrystalline graphite/CNT emitters 109
R. Gorski, B. Rozansky, H. Busta
Prairie Prototypes, USA
- P2.3. Progress in the development of a multiscale model of the field emission properties of carbon nanotube fibers 111
M. Cahay, W. Zhu, N. Perarulan, R. G. Forbes, S. B. Fairchild, T. C. Back, P. T. Murray
University of Cincinnati, USA; University of Surrey, UK; Air Force Research Laboratory, USA; University of Dayton, USA
- P2.4. Carbon nanotube thermionic emitter for a compact SEM gun N/A
M. Chang, K. Dridi, A. Nojeh, R. F. Pease
University of British Columbia, Canada; Stanford University, USA
- P2.5. Gated p-Si field emission cathode applied in an ionization vacuum gauge 113
C. Langer, C. Prommesberger, R. Lawrowski, R. Schreiner, Y. Huang, J. She
OTH Regensburg, Germany; Sun Yat-sen University, China
- P2.6. A 2D/3D image charge for modeling field emission N/A
K. L. Jensen, D. A. Shiffler, J. R. Harris, I. M. Rittersdorf, J. J. Petillo
Naval Research Laboratory, USA; Air Force Research Laboratory, USA; Leidos, USA
- P2.7. Development of a complete computational method to calculate electron emission currents from sharp dynamically evolving metal tips N/A
A. Kyrtsakis, K. Eimre, V. Zadin, V. Jansson, F. Djurabekova
University of Helsinki, Finland; University of Tartu, Estonia
- P2.8. Atomistic modeling of metal surfaces under high electric fields: direct coupling of electric fields to the atomistic simulations 115
M. Veske, A. Kyrtsakis, F. Djurabekova, R. Aare, K. Eimre, V. Zadin
University of Helsinki, Finland; University of Tartu, Estonia
- P2.9. Co-doped ZnO thin films prepared by nanocluster-beam deposition: synthesis at various flow rate of helium gas and annealing at different temperature N/A
X. Li, Z. Zhao
Southeast University, China
- P2.10. The physical principle of spin-polarized field emission 117
S.-D. Liang
Sun Yat-sen University, China
- P2.11. Fabrication of single-crystalline SmB₆ nanocone arrays and investigation of their field emission properties 119
X. Yang, H. Gan, L. Peng, Y. Tian, J. Chen, S. Deng, N. Xu, F. Liu
Sun Yat-sen University, China
- P2.12. Field emission behaviors of B/LaB₆ hierarchical heterojunction nanostructures 121
L. Peng, H. Gan, X. Yang, Y. Tian, J. Chen, S. Deng, N. Xu, F. Liu
Sun Yat-sen University, China
- P2.13. High density current electron emission from graphene 123
H. Zhai, J. Liu, C. Le, B. Zeng
University of Electronic Science and Technology of China, China
- P2.14. Thermionic emission from carbon nanotubes N/A
P. Liu, Y. Wei, L. Liu, K. Jiang, S. Fan
Tsinghua University, China
- P2.15. Coulomb blockade modulated current-voltage characteristic of a diamond field emitter 125
S. Mingels, V. Porshyn, D. Lützenkirchen-Hecht, G. Müller, V. I. Kleshch, A. N. Obraztsov
University of Wuppertal, Germany; Moscow State University, Russia; University of Eastern Finland, Finland

POSTER SESSION 2 (continued)

- P2.16. Atomistic study of field emission current from graphene nano-ribbon and effect of strain on field emission current 127
M. Behrooz, M. Monshipouri, Y. Abdi
University of Tehran, Iran
- P2.17. First principle method for studying field emission current of carbon nanotubes 129
M. Monshipouri, M. Behrooz, Y. Abdi
University of Tehran, Iran
- P2.18. Influence of light on field emission from carbon nanotube forests in presence of silver nanoparticles 131
M. Monshipouri, Y. Abdi, S. Darbari
University of Tehran, Iran; University of Tarbiat Modares, Iran
- P2.19. Work function measurement of Hf-oxide/W(100) surface by using of photoemission electron microscope 133
H. Nakane, T. Kawakubo
Muroran Institute of Technology, Japan; Kagawa National College of Technology, Japan
- P2.20. A field emission nano-focus x-ray source with effective electron beam focusing module 135
S. Park, J.-W. Jeong, J.-W. Kim, J.-T. Kang, J.-H. Yeon, M.-S. Shin, S. Kim, E. Go, H. Jeon, Y. C. Choi, Y.-H. Song
ETRI, Korea; UST, Korea
- P2.21. CNT paste emitters with minimal damage during high temperature vacuum brazing fabricated using fillers having low catalytic activities 137
S. Park, O. Floweri, N. Lee
Sejong University, Korea
- P2.22. Current-voltage characteristic hysteresis dependence on power supply regime for large area field emitters 139
S. V. Filippov, E. O. Popov, A. G. Kolosko, P. A. Romanov, E. I. Terukov, E. S. Ilin, M.R. Predtechenskiy
A.F. Ioffe Physico-Technical Institute, Russia; St.-Petersburg State Polytechnical University, Russia; The Bonch-Bruевич SPb State University of Telecommunications, Russia; OCSiAl Company, Russia; Kutateladze Institute of Thermophysics, Russia
- P2.23. Extracting formal emission area by on-line processing of current-voltage data, using FN-type equations for the Schottky-Nordheim barrier 141
E. O. Popov, S. V. Filippov, A. G. Kolosko, P. A. Romanov, R. G. Forbes
A.F. Ioffe Physico-Technical Institute, Russia; Peter the Great St.-Petersburg Polytechnical University, Russia; The Bonch-Bruевич SPb State University of Telecommunications, Russia; University of Surrey, UK
- P2.24. The technique of online analysis of the current-voltage characteristics of nanocomposite field emitters using the SK-charts 143
A. G. Kolosko, E. O. Popov, S. V. Filippov, I. U. Smirnov, Y. Gotoh
A.F. Ioffe Physico-Technical Institute, Russia; The Bonch-Bruевич SPb State University of Telecommunications, Russia; Peter the Great St.-Petersburg Polytechnical University, Russia; Kyoto University, Japan
- P2.25. Field emission behavior of Au-tip-coated p-type Si pillar structures 145
P. Serbun, V. Porshyn, G. Müller, S. Mingels, D. Lützenkirchen-Heicht, M. Bachmann, F. Düsberg, F. Dams, M. Hofmann, A. Pahlke, C. Prommesberger, C. Langer, R. Ławrowski, R. Schreiner
University of Wuppertal, Germany; KETEK GmbH, Germany; OTH Regensburg, Germany
- P2.26. Effect of crystallinity of graphene on its field emission character 147
S. Tang, Y. Zhang, S. Deng, J. Chen, N. Xu
Sun Yat-Sen University, China

POSTER SESSION 3

- P3.1. Modeling electron emission from polycrystalline diamonds N/A
O. Chubenko, S. S. Baturin, S. V. Baryshev
George Washington University, USA; Euclid TechLabs, USA
- P3.2. Improving the extraction of characteristic field enhancement factors from nonlinear Fowler–Nordheim plots in orthodox cold field electron emission N/A
T. A. de Assis
Federal University of Bahia, Brazil
- P3.3. The consequences of dependence between the formal area efficiency and the macroscopic electric field on linearity behavior in Fowler-Nordheim plots N/A
T. A. de Assis, F. F. Dall'Agnol, R. F. S. Andrade
Federal University of Bahia, Brazil; Federal University of Santa Catarina, Brazil
- P3.4. Surface morphology and field emitter cathode quality 149
D. Enderich, J. Booske, N. Behdad
University of Wisconsin-Madison, USA
- P3.5. Improving oxidation resistance of carbon nanotubes at high temperature using boron and phosphorus compounds 151
O. Floweri, S. Park, N. Lee
Sejong University, Korea
- P3.6. Non-resonant emission diode on silicon cathode with diamond like coating 153
N. M. Goncharuk, N. F. Karushkin
Research Institute "Orion", Ukraine
- P3.7. Evaluation of current density distribution of field emitted electrons by numerical simulation in conjunction with analytical approach 155
Y. Gotoh, H. Tsuji, M. Nagao
Kyoto University, Japan; National Institute of Advanced Industrial Science and Technology, Japan
- P3.8. Effect of microscale gas discharges on thermo-field emission current 157
J. R. Haase, D. B. Go
University of Notre Dame, USA
- P3.9. Field emission investigation of composites of polypyrrole with graphene oxide, reduced graphene oxide and graphene nanoribbons 159
K. Harpale, S. Bansode, M. More, D. J. Late
University of Pune, India; CSIR-National Chemical Laboratory, India
- P3.10. Spatial mapping of photoemission from plasmonic nanoparticles using electron-beam resists N/A
R. G. Hobbs, W. P. Putnam, A. Fallahi, Y. Yang, F. X. Kärtner, K. K. Berggren
Massachusetts Institute of Technology, USA; DESY, Germany; University of Hamburg, Germany
- P3.11. High mobility thin-film transistors formed by metal-induced crystallization of amorphous zinc tin oxide semiconductors N/A
S. T. Kim, N. On, K. J. Lee, H. J. Seul, J. K. Jeong
Hanyang University, Korea
- P3.12. Field emission properties of GNP emitters dependent on gap between anode and cathode 161
S. H. Lee, Y. Sun, C. J. Lee, Y.-H. Song
Korea University, Korea; ETRI, Korea
- P3.13. Fabrication of ZnO nanowire field emitter arrays with self-aligned focus electrode structure 163
Y. Liu, L. Zhao, Z. Zhang, D. Chen, G. Zhang, J. She, S. Deng, N. Xu, J. Chen
Sun Yat-Sen University, China
- P3.14. Fabrication and characterization of gated ZnO nanowire field electron emitters 165
L. Luo, J. She, S. Deng, J. Chen, N. Xu
Sun Yat-Sen University, China

POSTER SESSION 3 (continued)

- P3.15. Determination of geometrical form factor of emitter from Schottky plot 167
N. Torii, D. Sugie, H. Murata, E. Rokuta, H. Shimoyama, H. Yasuda, T. Haraguchi
Meijo University, Japan; PARAM Corporation, Japan
- P3.16. Aerospace environmental stability of nanostructured transfer mold amorphous carbon field emitter arrays 169
M. Nakamoto, J. Moon
Shizuoka University, Japan
- P3.17. Oxygen ratio dependent of positive bias stability and negative bias illumination stability in amorphous IGZO thin-film transistors N/A
N. On, S. T. Kim, K. J. Lee, H. Soel, J. K. Jeong
Hanyang University, Korea
- P3.18. Fabrication of miniature carbon nanotube electron beam module for x-ray tube application 171
J. H. Hong, J. S. Kang, K. C. Park
Kyung Hee University, Korea
- P3.19. High performance carbon nanotube electron beams with gate electrode optimization 173
J. S. Kang, K. C. Park
Kyung Hee University, Korea
- P3.20. Pseudo crystalline silicon (pc-Si) thin films with carbon nanotube electron beam exposure 175
H. R. Lee, J. S. Kang, M. T. Chung, K. C. Park
Kyung Hee University, Korea
- P3.21. Field emission from black silicon structures with integrated gate electrode 177
C. Prommesberger, C. Langer, R. Lawrowski, R. Schreiner
OTH Regensburg, Germany
- P3.22. Soluble-processed SiO₂ gate insulator fabrication via deep UV curing for amorphous oxide transistors N/A
H. J. Seul, N. On, K. J. Lee, S. T. Kim, J. K. Jeong
Hanyang University, Korea; Inha University, Korea
- P3.23. Single crystalline metallic molybdenum nano-pyramids: preparation and high current field emission properties 179
Y. Shen, N. Xu, Y. Zhang, J. Chen, J. She, S. Deng
Sun Yat-Sen University, China
- P3.24. High emission performance of carbon nanotube paste field emitters fabricated by graphite filler 181
Y. Sun, K. N. Yun, S. H. Lee, C. J. Lee
Korea University, Korea
- P3.25. Efficient fabrication of field emitters from super-aligned carbon nanotube arrays N/A
Y. Wei, P. Liu, L. Liu, K. Jiang, Q. Li, S. Fan
Tsinghua University, China
- P3.26. Fabrication of amorphous IGZO thin film transistor for active-driving of ZnO nanowire field emitters 183
X. Li, X. Chen, Z. Zhang, H. Ou, J. She, S. Deng, N. Xu, J. Chen
Sun Yat-Sen University, China
- P3.27. Tuning field emission properties of tungsten trioxide nanowires for flat panel x-ray source application 185
P. Xie, D. Chen, G. Zhang, Z. Zhang, F. Liu, J. She, S. Deng, N. Xu, J. Chen
Sun Yat-Sen University, China
- P3.28. Modulation of the work function of graphene by Na and Cl co-adsorbed on opposite sides on graphene 187
G. Yuan, X. Song, H. Mimura
Ocean University of China, China; Shizuoka University, Japan