

2006 International Symposium on Discharge and Electrical Insulation in Vacuum Proceedings

**Matsue, Japan
September 25-29, 2006**

Volume 1 of 2



IEEE Catalog Number: 06CH37774
ISBN: 1-4244-0191-7

Table of Contents

Development of Electrical Insulation Techniques in Vacuum for Higher Voltage Vacuum Interrupters.....	1
<i>Hitoshi Okubo</i>	
Vacuum Breakdown between Molten Metal Electrodes	7
<i>Gabriela Sandolache, Stephen William Rowe</i>	
Dielectric Performance of Vacuum Interrupters after Switching	11
<i>U. Ernst, K. Cheng, X. Godechot, M. Schlaug</i>	
Optimization of Electrode Contour for Improvement of Insulation Performance of High Voltage Vacuum Circuit Breaker	15
<i>K. Kato, H. Okubo</i>	
Investigation of the Electric Strength Recovery Process in the Pseudospark Switch with a High Pulse Repetition Rate to 10 kHz	19
<i>Yu.D. Korolev, O.B. Frants, V.G. Geyman, R.V. Ivashov, V.N. Landl, I.A. Shemyakin</i>	
Field Emission from Metals in Strong Electric Fields	23
<i>G. A. Mesyats, I. V. Uimanov</i>	
Pulsed Electric Strength of Centimeter Vacuum Gaps	27
<i>A.A. Emelyanov</i>	
Vacuum Electric Strength for Pulses of Various Shape	31
<i>A.A. Emelyanov, E.A. Emelyanova</i>	
Pulsed Electric Strength and Full-Voltage Effect	35
<i>E.A. Emelyanova</i>	
Clump Hypothesis and Mechanisms of Breakdown Initiation in Centimeter Vacuum Gaps	39
<i>Nevrovsky V.A.</i>	
Cathode and Anode Phenomena at Initiation of Pulsed Vacuum Breakdown.....	42
<i>A. V. Batrakov, D. J. Johnson, S. A. Onischenko, D. I. Proskurovsky</i>	
Formative Time Lag to Breakdown in Micro Gap at Low Atmospheric Pressure	46
<i>K. Nitta, S. Matsuoka, M. Chiba, K. Hidaka</i>	
Investigation of a plasma flow of a short vacuum spark	50
<i>I. L. Muzukin</i>	
Breakdown Conditioning Characteristics of Long Gap Electrodes in Vacuum.....	53
<i>Yuji Fukuoka, Takanori Yasuoka, Katsumi Kato</i>	
Conditioning of Series Vacuum Interrupters (VIs) for Medium Voltage by Applying High-Frequency (HF) Current to Increase the Dielectric Strength of VIs	57
<i>H. Fink, D. Gentsch, B. Heil, C. Humpert, A. Schnettler</i>	
Dielectric investigations on micro discharge currents and conditioning behaviour of vacuum gaps.....	61
<i>Michael Budde, Michael Kurrat</i>	
On the Mechanism of the Anomalous Acceleration of Ions in Vacuum and Plasma Diodes	65
<i>D.L. Shmelev, S.A. Barengolts</i>	
Investigation of Electrode Conditioning Mechanism in Vacuum with Impulse Voltage Application	69
<i>K. Kato, T. Yasuoka, Y. Fukuoka, H. Saitoh, M. Sakaki, H. Okubo</i>	
The role of emission properties in non-sustained disruptive discharge (NSDD) evolution	73
<i>Jurij V. Khvorost, Andrew S. Baturin, Eugeny P. Sheshin</i>	
Energy Input Regimes in the EUV Radiation Source Based on the Pseudospark Discharge	77
<i>Yu.D. Korolev, O.B. Frants, V.G. Geyman, R.V. Ivashov, V.N. Landl, I.A. Shemyakin</i>	
Simple and Accurate Modeling of Transient Discharging Phase at Low Pressure in Cylindrical Reactor.....	81
<i>Bong Seong Kim, Kwang-Cheol Ko</i>	

Table of Contents

Secondary Electron Emission from Alumina RF Windows	85
<i>S. Michizono</i>	
Influence of Mechanical Finishing on Secondary Electron Emission of Alumina Ceramics	91
<i>Suharyanto, S. Michizono, Y. Saito, Tumiran, Y. Yamano, S. Kobayashi</i>	
Gas breakdown in a micro-gap caused by triboelectricity during sliding friction between insulators	95
<i>T. Miura, I. Arakawa</i>	
Investigation on Novel Characterization Parameters of Surface Flashover Phenomena in Vacuum	99
<i>Guan-Jun Zhang, Wen-Bin Zhao, Nan Zheng, Zhang Yan</i>	
Flashover and Charging Characteristics of a Long Solid Insulator Exposed to ac Voltage in Vacuum.....	103
<i>Osamu Yamamoto, Hirotaka Hayashi, Takehiro Satoh, Shoji Hamada, Tetsuo Kobayashi, Hiroshi Omura, Hiroshi Morii</i>	
Charging Control on Alumina Surface in Vacuum by Surface Roughness and Electric Field Distribution.....	107
<i>Takafumi Hosono, Katsumi Kato, Ayumu Morita, Hitoshi Okubo</i>	
Effect of the selective acceleration of light ions in vacuum flashover, combined with a vacuum gap breakdown.....	111
<i>I.L. Muzukin, S.V. Barakhvostov</i>	
Photoelectron Emission of TiN-coated Alumina Excited by Ultraviolet Light.....	114
<i>Suharyanto, T. Okano, S. Michizono, Y. Saito, Tumiran, Y. Yamano, S. Kobayashi</i>	
Effect of Low Pressure on Insulation Failure of Silicone Rubber for Polymer Insulator	118
<i>B. X. Du, Zhenhua Wang, Yong Liu</i>	
Chaos Analysis of Discharge Current on Phenolic Resin under Reduced Pressure	122
<i>B. X. Du, Liang Gu, D.S.Dong</i>	
Effect of Low Pressure and Magnetic Field on Dielectric Breakdown of Printed Circuit Board.....	126
<i>B. X. Du, Y. Gao</i>	
Investigation on Surface Insulation Strength of Machinable Ceramic Material under Pulsed Voltage in Vacuum.....	130
<i>Guan-Jun Zhang, Wen-Bin Zhao, Xin-Pei Ma, Kui Ma, Nan Zheng, Zhang Yan</i>	
Effect of chromium oxide coating on surface flashover characteristics of ceramic in vacuum	134
<i>Tetsu Shioiri, Naoki Asari, Shin Saito, Hironori Nakamura, Mitsutaka Homma, Katsumi Suzuki</i>	
Depression of Insulator Charging in Vacuum by Partial Mechanical Processing	138
<i>O. Yamamoto, S. Markon, Hiroshi Morii, Hiroshi Omura</i>	
Surface Charge Distributions on Insulators in Vacuum Measured by Electro-Optic Effect.....	142
<i>M. Miyazaki, Y. Yamano, S. Kobayashi, Y. Saito</i>	
Measurement of 2-Dimensional Surface Charge Distributions under Vacuum Flashover Events on Insulators with Sub-milli-second temporal resolution.....	146
<i>Yasushi Yamano, M. Miyazaki, Shinichi Kobayashi, Yoshio Saito</i>	
Multilayer High-Gradient Insulators.....	150
<i>J. R. Harris</i>	
Dielectric Strength and Statistical Property of Single and Triple-Break Vacuum Interrupters in Series	153
<i>Liao Min-fu, Zou Ji-yan, Duan Xiong-ying, Fan Xing-ming, Sun Hui</i>	
The Arc Behavior and the Interruption Ability of the Transversal Magnetic Field Electrode in the Vacuum Interrupter	157
<i>Yoshimitsu Niwa, Kosuke Sasage, Kunio Yokokura, Eiji Kaneko</i>	
Diagnosis of Vacuum Degree in Vacuum Interrupter Based on Partial Discharge	161
<i>M. Kamarol, S. Ohtsuka, H. Saitou, M. Sakaki, M. Hikita</i>	

Table of Contents

Study on New Method for Measurement of Internal Pressure of Vacuum Interrupters	165
<i>Zhao Ziyu, Song Huansheng, Jiang Xuchen, Ma Naixiang, Luo Liwen, Ji Yansong, Li Man</i>	
On-line Monitoring of Mechanical Characteristics for Vacuum Circuit Breaker	169
<i>Yundong Cao, Shibo Yin, Ming Zong, Chunguang Hou</i>	
Electrical Life of Vacuum Interrupters	173
<i>M. Schlaug, L. Dalmazio, U. Ernst, X. Godechot</i>	
Discharge Properties in Low Vacuum Monitoring Method for Vacuum Circuit Breakers.....	177
Research on Vacuum Arc Characteristics of a New Electrode Structure Applied in High Voltage Vacuum Interrupter	181
<i>Cheng Shaoyong, Xiu Shixin, Wang Jimei, Shen Zhengchao</i>	
A Utility Method of a High Voltage Vacuum Interrupter Design	185
The ultra high voltage device with vacuum insulation	189
<i>Danshuheng, Tang Xinlong, Wang Dezhong, Zhupingyuan</i>	
A withstand voltage characteristics of two series of a vacuum interrupter.....	192
<i>Y. Shiba H. Fujimori, N. Ide, S. Yanabu, H. Ichikawa, Y. Matsui, M. Sakaki</i>	
"Vacuum for HV applications - Perhaps not so new? - Thirty Years Service Experience of 132kV Vacuum Circuit breaker"	196
<i>L.T. Falkingham, M. Waldron</i>	
Vacuum Interrupter Design for HV and VHV Applications	200
<i>L.T. Falkingham</i>	
High Voltage Breakdown Performance and Circuit Isolation Capability of Vacuum Interrupters	204
<i>Erik D. Taylor, Paul G. Slade</i>	
Current-Zero Characteristics of a Vacuum Circuit Breaker at Short-Circuit Current Interruption	208
<i>E. P. A. van Lanen, R. P. P. Smeets, Marjan Popov, Lou van der Sluis</i>	
Moving Arc Study and Plasma Diagnosis in the Case of Vacuum Interrupter with TMF Contacts	212
<i>D. Pavelescu, G. Dumitrescu, G. Pavelescu, F. Gherendi, S. Nitu, V. Braic, P. Anghelita, P. Lungu</i>	
Interaction of a Vacuum Arc with an SF₆ Arc in a Hybrid Circuit Breaker during High-Current Interruption.....	216
<i>R.P.P. Smeets, V. Kertész, D. Dufournet, D. Penache, M. Schlaug</i>	
Studies of the Stable Stage of the Electric Arc Burning at the Contact Separation in a Vacuum Gap with a Transverse Magnetic Field.....	220
<i>D.F. Alferov, D.V. Yevsin, Ya.I. Londer</i>	
A PIC-MCC Simulation of the High-Voltage Interruption Ability of a Vacuum Interrupter.....	224
<i>S. Takahashi, K. Arai, O. Morimiya, N. Okabe, S. Kaneko, T. Yokoi</i>	
Pulse forming technology on crowbar circuit of two parallel-connected triggered vacuum gaps	228
<i>Akira Sugawara</i>	
Delay Characteristics and Controller Design of a Triggered Vacuum Switch.....	232
<i>Liao Min-fu, Duan Xiong-ying, Zou Ji-yan</i>	
Verification of a Fast Making Switch Based on Triggered Vacuum Switch and Vacuum Circuit Breaker	236
<i>Fan Xing-ming, Qiu Hong-hui, Liao Min-fu, Zou Ji-yan</i>	
Countercurrent Breaking by Vacuum Interrupter Combined in Parallel with Vacuum Switch	240
<i>Egorov O.G.</i>	
Development of High Voltage Vacuum Circuit Breakers in China.....	243
<i>Jimei Wang, Zhiyuan Liu, Shixin Xiu, Zhongyi Wang, Shun Yuan, Li Jin, Heming Zhou, Ren Yang</i>	
Development and Technology of High Voltage VCBs; Brief History and State of Art	249
<i>Y. Matsui, K. Nagatake, M. Takeshita, K. Sakaki</i>	

Table of Contents

High Voltage Vacuum Interrupters - Technical and Physical Feasibility versus Economical Efficiency -	253
<i>R. Renz</i>	
High-Voltage Vacuum Circuit Breaker a Feasibility Study.....	259
<i>Hans Schellekens, Georges Gaudart</i>	
Experimental Investigation and Simulation of Vacuum Arc under Axial Magnetic Field: A Review	263
<i>Shenli Jia, Zongqian Shi, Lijun Wang</i>	
Numerical simulation of a moving high-current vacuum arc driven by a transverse magnetic field (TMF).....	269
<i>T. Delachaux, O. Fritz, D. Gentsch, E. Schade, D.L. Shmelev</i>	
Thermodynamic Model of Moving Vacuum Arcs on Contrace Contacts	273
<i>D. W. Branston, W. Haas, W. Hartmann, R. Renz, N. Wenzel</i>	
Effect of Magnetic Field for Sustaining Low Current DC Vacuum Arcs	277
The Effect of Conact Material Composition of AgWC and Axial Magnetic Field Intensity on Interrupting Capability and Chopping Current	281
<i>Satoshi Ochi, Seiichi Miyamoto, Hiromi Koga, Norio Kan, Takakazu Harada, Takefumi Ito, Kenichi Koyama, Shia Yamade</i>	
Analysis of Axial Magnetic Field of Slot Type Axial Magnetic Field Contacts with Iron Plates	285
<i>Zhiyuan Liu, Yaping Hu, Jimei Wang, Quan Wang, Dongli Bi, Guangli He</i>	
A New Slot Type Axial Magnetic Field Contact with Low Resistance.....	289
<i>Zhiyuan Liu, Zheng Wang, Jimei Wang</i>	
An Interrupting Capacity Model of Axial Magnetic Field Vacuum Interrupters with Slot Type Contacts.....	293
<i>Zhiyuan Liu, Shaoyong Cheng, Xuan Zhang, Jimei Wang, Quan Wang, Guangli He</i>	
Effect of the Axial-Symmetrical Two-Dimensional Magnetic Field on the Configuration of a Vacuum Arc Discharge	297
<i>E.F. Prozorov, K.N. Ulyanov, V.A. Fedorov</i>	
Mathematical Model of the Vacuum Arc in an External Axial Magnetic Field.....	301
<i>Ya.I. Londer, K.N. Ulyanov</i>	
High-Current Vacuum Arc in a Strong Axial Magnetic Field.....	305
<i>A.M.Chaly, A.A. Logatchev, K.K. Zabello, S.M. Shkol'nik</i>	
Effect of Amplitude and Inclination of Magnetic Field on Low-Current Vacuum Arc	309
<i>A.M.Chaly, A.A.Logatchev, K.K.Zabello, S.M.Shkol'nik</i>	
Analysis of Axial Magnetic Field electrode applied to high voltage Vacuum Interrupters.....	313
<i>Xiu Shixin, Pang Lei, Wang Jimei, Lin Jianfei, He Guangli</i>	
Experimental Investigation on the Arc Modes Transition of the AMF Electrode with One Turn Coil Structure.....	317
<i>Cheng Shaoyong, Xiu Shixin, Wang Jimei, Sheng Zhengchao</i>	
Numerical Simulation of Cathode SPot Motion in Magnetic Fields.....	321
<i>V.P. Afanas'ev, A.M. Chaly, V.A. Kuptsov, S.M. Shkol'nik</i>	
MHD simulation of high-current vacuum arc under different axial magnetic fields	325
<i>Lijun Wang, Shenli Jia, Zongqian Shi, Ling Zhang, Mingzhe Rong</i>	
Model for the Transition to the Diffuse Column Vacuum Arc Based on an Arc Voltage Criteria.....	329
<i>M. Keidar, E.D. Taylor</i>	
Statistical Simulation on the Random and Retrograde Motion of Single Cathode Spot of Vacuum Arc	333
<i>Zongqian Shi, Jia Xiao, Shenli Jia, Yue Zhang, Lijun Wang</i>	
Maximum Interrupting Capacity of CuCr Contacts under the effect of uniform axial magnetic field (AMF)	337
<i>Alexey M.Chaly, Irina N. Poluyanova, Victor N. Poluyanov</i>	

Table of Contents

Analysis of Axial Magnetic Field Characteristics of Coil Type Axial Magnetic Field Vacuum Interrupters	340
<i>Zhongyi Wang, Zhiyuan Liu, Xuan Zhang, Yuesheng Zheng, Jimei Wang</i>	
Comparison of Axial Magnetic Field Characteristics of Four Axial Magnetic Field Vacuum Interrupter Contacts	344
<i>Zhongyi Wang, Zhiyuan Liu, Xuan Zhang, Yuesheng Zheng, Jimei Wang</i>	
Expanding Characteristics of Vacuum Arc Plasma in Radial and Axial Direction.....	347
<i>M. Ouchi, T. Yanagidaira, K. Tsuruta</i>	
Analysis of Magnetic Field Characteristics of Vacuum Interrupters with Cup type Axial Magnetic Field Contacts Based on Orthogonal Design.....	351
<i>Yuesheng Zheng, Zhongyi Wang, Zhiyuan Liu, Mengmeng Hao, Jimei Wang</i>	
Low Current Vacuum Arc Diagnostics.....	354
<i>Alexander Batrakov</i>	
Measurement of ion flux as a function of background gas pressure in a Hot Refractory Anode Vacuum Arc.....	360
<i>I. I. Beilis, A. Shashurin, R. L. Boxman</i>	
The numerical calculation of the model of small current vacuum arc cathode spot.....	364
<i>Dan Shuheng, Lihongqun, Tang Xinlong</i>	
Fourier Analysis of Fast Vacuum Arc Parameters.....	368
<i>André Anders, Efim M. Oks, Georgy Yu. Yushkov</i>	
Use of Droplet Spots Burning for Decreasing of Droplet Fraction in Vacuum Arc Plasma	372
<i>D.I. Proskurovsky</i>	
Non-Sustained Disruptive Discharge Phenomena After Current Interruption in Vacuum Gap	376
<i>H.Tanaka, M.Okawa, S.Yanabu</i>	
Influence of Gap Distance on the Arc Modes Transition of Cup Type AMF Electrode.....	380
<i>Cheng Shaoyong, Xiu Shixin, Wang Jimei, Li Xing</i>	
Non Steady Cathode Spot Operation at a Micropromtrusion in a Vacuum Arc	384
<i>I. I. Beilis</i>	
Estimation of Contact material in Vacuum Circuit Breaker	388
<i>T. Yamamoto, H.Tanaka, M. Toruson, S. Yanabu, R. Renz</i>	
The Electrode Surface State after Current Interruption in Vacuum Circuit Breaker.....	392
<i>Naotaka Ide, Ryohei Sakuma, Eiji Kaneko, Satoru Yanabu</i>	
Simulation of The Thermal Process of Anode In Drawn Vacuum Arc.....	396
<i>Zongqian Shi, Shenli Jia, Hong Dong, Lijun Wang</i>	
Ion Erosion Rate in a High Current Vacuum Spark	400
<i>S.P. Gorbunov, V.I. Krasov, V.L. Paperny, Yu V. Korobkin, I.V. Romanov</i>	
Cathode Spot Movement of Low Pressure Arc Removing Oxide Layer.....	403
<i>A. Sato, T. Iwao, M. Yumoto</i>	
Small Direct Current Interruption Phenomena in a Vacuum Circuit Breaker	407
<i>Motoya Shinjyo, Yasushi Taira, Takahiro Uehara, Eiji Kaneko</i>	
Numerical Calculation of Current Density Distribution in a Vacuum Arc	411
<i>Masakazu Nagashima, Kazushi Yogi, Takashi Tsuji, Eiji Kaneko</i>	
Experimental Evaluation of the High-Current Drawn Arc Energy Balance	415
<i>V. A. Dmitriev, V. N. Poluyanov, I. N. Poluyanova</i>	
Relation Between Cathode Processes and Voltage Instabilities of Low Current Vacuum Arc	419
<i>M. B. Bochkarev</i>	

Table of Contents

Model of Arc Root Immobility in Vacuum Circuit Breakers	423
<i>S.N. Kharin</i>	
Charge and velocity distribution of ions emitted from two simultaneously operating and serially connected vacuum arcs.....	428
<i>Guy Shafir, Samuel Goldsmith, Eli Cheifetz</i>	
Contact Material for Vacuum Interrupters based on CuCr with a Specific High Short Circuit Interruption Ability	432
<i>D. Gentsch</i>	
Thermodynamic Models for RMF - and AMF - Vacuum Arcs	438
<i>R. Renz</i>	
Controlled Switching of Shunt Capacitor Banks with Vacuum Circuit Breaker	442
<i>F. H. Ding, X. Y. Duan, J. Y. Zou, M. F. Liao</i>	
Synthetic Tests of Capacitive Current Switching Using a Test Vessel.....	446
<i>Florian Körner, Manfred Lindmayer, Michael Kurrat, Dietmar Gentsch</i>	
Relevancy of IEC Requirements Related to Switching Cable and Line Charging Currents for Medium Voltage Vacuum Circuit Breakers (VCB)	450
<i>A. M. Chaly, I. N. Poluyanova</i>	
Challenges For Vacuum Interrupter Design	453
<i>R. Parashar, A. Baker, A. Sitzia</i>	
Development of the CAPP System Based on Integrated Planning Method for Vacuum Interrupter	457
<i>Xiu Shixin, Ji Liang, Chen Lingfei, Shen Zhengchao</i>	
Development of the Vacuum Interrupter Computer Aided Design System VI-CAD	461
<i>Xiu Shixin, Chen Lingfei, Ji Liang, Pang Lei</i>	
The Development of Low-surge-type VCB with a Balanced-type Magnetic Actuator	465
<i>Kenji Kato, Yasuhiro Matsumoto, Kazuhiro Matsuo, Mitsutaka Homma</i>	
Influence of Over-voltage Caused by Chopping Current on Electric Field Distribution in Vacuum Interrupter	469
<i>Gao Youhua, Liu Yanjiu, Wang Erzhi, Cao Yundong, Liu Xiaoming</i>	
Calculation and Analysis of Transient Electric Field of 10kV Outdoor Vacuum Circuit Breaker under Lightning Impulse.....	473
<i>Gao Youhua, Wang Erzhi, Li Yanbin, Cao Yundong, Liu Xiaoming</i>	
Influence of Irons on Magnetic Field Characteristics of Vacuum Interrupter with Cup type Axial Magnetic Field Contacts.....	477
<i>Yuesheng Zheng, Zhongyi Wang, Zhiyuan Liu, Mengmeng Hao, Jimei Wang</i>	
Electric Field Calculation for Vacuum Interrupter by Optimized Charge Simulation Method	480
<i>Wang Erzhi, Han Changwei, Liu Xiaoming, Cao Yundong</i>	
Analysis on the damage reason of vacuum circuit breakers	484
<i>Danshuuheng, Wujianwen, Wang Dezhong</i>	
Fault Analysis in DC Electric Railways Feeding System.....	487
<i>Ryouhei Ikeda, Eiji Kaneko</i>	
Research on Intelligent Vacuum Circuit Breaker Controller based on Embedded Network Control System	491
<i>Yundong Cao, Feng Li, Xiaoming Liu, Chunguang Hou</i>	
Optimum Design of Vacuum Interrupter Using Chaotic Neural Network.....	495
<i>Yundong Cao, Shixun Liu, Xiaoming Liu, Erzhi Wang, Yuhuan Zhao</i>	
Numerical Simulation of 3D Electromagnetic Field for Vacuum Interrupter	499
<i>Xiaoming Liu, Tao Tang, Yundong Cao, Erzhi Wang</i>	

Table of Contents

Multivariable Optimal Design of Vacuum Interrupter using Novel Self-adaptive Genetic Algorithm	503
<i>Xiaoming Liu, Fuyue Wen, Yundong Cao, Erzhi Wang, Yuhuan Zhao</i>	
Design and Analyses on Permanent Magnet Actuator for Mining Vacuum Circuit Breaker	507
<i>Chunguang Hou, Jing Sun, Yundong Cao, Xiaoming Liu, Erzhi Wang</i>	
The Influence of Mechanical Properties of Contact Materials on the Contact Performance	511
<i>Baihe Miao, Yan Zhang, Guoxun Liu</i>	
Field Enhancement at a Triple Junction in Arrangements Consisting of Three Media.....	515
<i>Tadasu Takuma, Tadashi Kawamoto</i>	
Review of Cathodic Arc Deposition for Preparing Droplet-Free Thin Films.....	519
<i>Hirofumi Takikawa</i>	
A Hybrid Plasma Generation Triggered by a Shunting Arc Discharge Using a Positively Biased Electrode.....	525
<i>K. Yukimura, T. Imai, I. Levchenko, K. Takaki, T. Ikehata</i>	
Progress in Use of Ultra-High Vacuum Cathodic Arcs for Deposition of Thin Film Superconducting Layers	529
<i>J. Langner, M.J. Sadowski, P. Strzyzewski, R. Mirowski, J. Witkowski, S. Tazzari, L. Catani, A. Cianchi, J. Lorkiewicz, R. Russo, T. Paryczak, J. Rogowski, J. Sekutowicz</i>	
Investigation of Plasma Recovery during Fall Time in Plasma Source Ion Implantation	533
<i>K. J. Chung, J. M. Choe, G. H. Kim, Y. S. Hwang</i>	
Determination of Plasma Current on the Electrode Biased a High Negative Potential.....	537
<i>Hui-Dong Hwang, Jae-Myeong Choe, Kyung-Jae Jung, Kwang-Chul Ko, Yong-Seok Hwang, Gon-Ho Kim</i>	
Fractional Diversion of Discharge Current into Conductive Bodies in Contact with Plasmas.....	540
<i>A. F. Alexandrov, H. J. Lee, C. K. Choi, V. Yu. Plaksin, V. A. Riaby, V. P. Savinov</i>	
Effect of Pressure on Surface Roughness Treated by Cathode Spots of Low Pressure Arc	544
<i>M. Saito, S. Tobe, T. Iwao, T. Inaba</i>	
Plasma-Chemical Processing of Silicon Substrates Using a Novel Arc Plasmatron	548
<i>Vadim Yu. Plaksin, Valentin A. Riaby, Ji Hoon Kim, Chi Kyu Choi, Heon Ju Lee</i>	
Plasma CVD for Producing Si Quantum Dot Films	552
<i>Shinya Iwashita, Hiroomi Miyahara, Kazunori Koga, Masaharu Shiratani, Shota Nunomura, Michio Kondo</i>	
Local Adhesion of Diamond-Like Carbon Films Coated on Substrates in a Trench-shaped Cathode	555
<i>Masami Ohnishi, Hiroshi Nozaki, Hodaka Osawa, Kazushi Minaki, Koichi Kitajima, Katsuhiko Yokota</i>	
Effects of Annealing on the Optical Absorption Spectrum of Strontium Titanate Implanted with Ag Ions.....	559
<i>Y. Saito, K. Ijima, T. Kudo, N. Mitui</i>	
The Surface Modification effect by irradiation of a surface wave excited by hydrogen plasma onto zinc oxide thin films	563
<i>Takamichi Nakayama, Tsutomu Takizawa, Yuichi Sakamoto, Kunihiro Kashiwagi</i>	
Improvement on the Property of TiO₂ Films due to Plasma Processing.....	566
<i>H. Murata, T. Sakamaki, A. Yoshizawa, M. Uwatoko, S. Kogoshi</i>	
Surface Characteristics Modification by Plasma Flow.....	570
<i>A. M. Dobrovolskii, A. N. Esvyukov, A. A. Goncharov, R. N. Kravchuk, I. M. Protsenko, O. V. Yaroshchuk</i>	
Roughness and Cross Section of SUS430 Surface Treated by Using Low Pressure Arc and Treatment Time	574
<i>Y. Inagaki, T. Iwao, M. Yumoto</i>	
Dependence of Accelerating Voltage on Surface Hardness of PMMA by Low Energy Nitrogen Ion Irradiation	578
<i>Takahiro Masaki, Masako Arai, Toru Iwao, Motoshige Yumoto</i>	

Table of Contents

Dependence of Initial Surface Roughness for Treated Surface by Cathode Spots of Low Pressure Arc	582
<i>T. Iwao, A. Sato, M. Yumoto</i>	
Composition Control of Bi₂Sr₂Can-1CunOy Superconducting Thin Films by rf Magnetron Sputtering Method.....	586
<i>T. Yamane, S. Kishida, H. Tanaka, H. Yoshikawa</i>	
Effect of Gas Pressure on Decomposition of Indigo Carmine in Water Subjected to Reciprocal Traveling Wave Voltage Pulse	590
<i>K. Kadokawa, T. Sone, H. Nishiyama, I.I. Kitani</i>	
RF PE-CVD Characteristics for the Growth of Carbon Nanotubes in a CH₄/N₂ mixed gas	594
<i>Youl-Moon Sung, Toshifumi Yuji, Tatsuya Sakoda</i>	
Analysis of Electron Energy Distribution Function from a Langmuir Probe Data Using the Bi-orthogonal Wavelet Transform.....	598
<i>Jae-Myeong Choe, Je-Hun Woo, Dai-Gyoung Kim, Gon-Ho Kim</i>	
The Effect of an Auxiliary External Electrode on Low-pressure Xenon Pulsed Discharge	602
<i>M. Okamoto, K. Koyama, H. Kurokawa, H. Motomura, M. Jinno</i>	
Characteristics of Low-pressure Xenon ICP discharge	606
<i>Akira Kondo, Ahmad Nazri Dagang, Hideki Motomura, Masafumi Jinno</i>	
A New Type of Dielectric Barrier Discharge Using Double Helical External Electrodes Anode	610
<i>Hideki Motomura, Yusuke Muguruma, Tatsuya Matsuda, Shuji Takubo, Masafumi Jinno</i>	
Development of X-Shape Filtered Arc Deposition (X-FAD) Apparatus and DLC/Cr Film Preparation	614
<i>H. Hikosaka, Y. Iwasaki, H. Tanoue, H. Takikawa, T. Sakakibara, H. Hasegawa</i>	
Simultaneous Measurements of Neutrons and Energetic Protons from D-D and D-3He Fusion Reactions in an Inertial Electrostatic Confinement Device	618
<i>K. Masuda, S. Ogawa, T. Takamatsu, K. Yoshikawa</i>	
Terasawa-type small X-Ray Gas Tubes and its Application to Neutralizer for Static Electricity.....	622
<i>Jun Kawai, Hideshi Ishii, Yoshinori Hosokawa</i>	
Optimization of a gas jet-type Z-pinch discharge EUV light source	624
<i>Naoya Iizuka, Nozomu Kishi, Inho Song, Toshiro Sakamoto, Yasunori Kobayashi, Smruti R. Mohanty, Masahito Watanabe, Akitoshi Okino, Eiki Hotta</i>	
Experimental Observation of Large-Scale Electron Vortex Structures in the Electrostatic Plasma Lens	628
<i>Yu. Chekh, A. Goncharov, I. Protzenko</i>	
Improvement of Inertial Electrostatic Confinement Device by Lowed Operating Gas Pressure using Magnetron-Discharge-Based Ion Source	632
<i>T. Takamatsu, T. Oishi, K. Masuda, K. Yoshikawa</i>	
The Effect of Grid Cathode Geometry on Neutron Production Rate in SCBF Device.....	636
<i>Heung-Jin Ju, Jeong-Ho Park, Kwang-Cheol Ko</i>	
Bi-Maxwellian electron energy distributions in the edge of the CAPRICE ECR ion sources	640
<i>Y. H. You, F. W. Meyer, K. S. Chung</i>	
Preliminary Study of Beam-Beam Reactions in IEC Fusion Device	644
<i>Kei Nozaki, Kunihito Yamauchi, Sonoe Ohura, Masato Watanabe, Akitoshi Okino, Eiki Hotta</i>	
Application of low-energy secondary emission electron gun for VOC treatment.....	648
<i>Asuna Fukamachi, Masato Watanabe, Akitoshi Okino, Kwang-Cheol Ko, Eiki Hotta</i>	
Ion Electrostatic Acceleration in a Pulsed Micro Plasma	652
<i>Takeshi Yanagidaira, Satoshi Kawahara, Koichi Tsuruta</i>	
Soft X-ray radiation from nitrogen filled capillary z-pinch plasma.....	656
<i>Yusuke Sakai, Takanori Komatsu, Yifan Xiao, Inho Song</i>	

Table of Contents

Computer Simulation of Beam Extraction and Transport for Vacuum Arc Based Ion and Electron Sources.....	660
<i>I. V. Litovko</i>	
Discharge characteristics of helium under inhomogeneous pressure distribution.....	664
<i>Y. Gotoh, C. Ichihara, A. Kobayashi, T. Hirano, H. Tsuji, J. Ishikawa</i>	
Development of a Cylindrical Neutron Generator using RF-driven Plasma.....	668
<i>K. J. Chung, H. D. Jung, J. Y. Park, Y. S. Hwang</i>	
Status report on Vacuum Arc Ion Source operation at the GSI accelerator facility	672
<i>M. Galonska, R. Hollinger</i>	
Penning-like Energy Transfer between Argon and Nitrogen	675
<i>Tatsuya Matsuda, Tsuyoshi Sato, Hideki Motomura, Masafumi Jinno</i>	
VUV emission by XeI excimer in Low-Pressure Xenon-Iodine mixture.....	679
<i>Masashi Watanabe, Hidefumi Taniuchi, Hideki Motomura, Masafumi Jinno</i>	
Emittance Studies of the High Current Ion Sources at GSI	683
<i>R. Hollinger, M. Galonska, R. Mayr</i>	
A Portable Neutron Source using by Spherically Convergent Beam Fusion Device	687
<i>Jeong Ho Park, Heung Jin, Ju Kwang, Cheol Ko</i>	
Plasma Devices Based on the Plasma Lens Configuration - Basic Results and Application (Review)	690
<i>Alexey A. Goncharov, Ian G. Brown</i>	
Vacuum insulator requirements and design for the 100 terawatt upgrade to the Z pulsed power driver.....	696
<i>M.E. Savage, L.F. Bennett, J.M. Elizondo, A.C. Owen, R.W. Shoup, B.S. Stoltzfus, K.W. Struve, W.A. Stygar, L.L. Whinnery</i>	
Optimization of the LaB6 Cathode for Divertor Plasma Simulator (DiPS)	700
<i>H.-J. Woo, K.-S. Chung, H.-J. You, Y.-J. Seo, G.-S. Choi, T. Lho</i>	
Analysis of Secondary Electrons in a Plasma Direct Converter Simulator for Advanced Fusion	704
<i>H. Takeno, T. Yamamoto, R. Kurumatai, T. Mori, Y. Yasaka</i>	
Study of Electric Potential of Dielectric Target Irradiated by Ion-Plasma Flow	708
<i>A. M. Dobrovolskii, A. N. Evsyukov, A. A. Goncharov, O.A. Panchenko, I. M. Protsenko</i>	
Breakdown Phenomena in the Negative Ion Source of 500 keV Negative-Ion Based NBI System on JT-60U	712
<i>Masaya HANADA, Yoshitaka IKEDA, Masaki KAMADA, Katsumi KIKUCHI, Masao KOMATA, Kazuhiko MOGAKI, Naotaka UMEDA, Katsutomi USUI, Larry R.GRISHAM, Shinichi KOBAYASHI</i>	
Discharge Characteristics of Anode Size in an Inertial Electrostatic Confinement Fusion	716
<i>Hodaka OSAWA, Shigehisa YOSHIMURA, Takehiro TABATA, Masami Ohnishi</i>	
A Compact x-ray Radiography Accelerator Using High-Gradient Vacuum Insulator Technology	720
<i>Yu-Jiuan Chen, James F. McCarrick, Scott D. Nelson</i>	
Modeling of Secondary Arc Conditions on Satellite Solar Array.....	724
<i>M. Cho</i>	
ESD-Triggered Arcing Discharges between Wires in Vacuum	728
<i>H. Fujii, K. Kawabe</i>	
Activities of Laboratory of Spacecraft Environment Interaction Engineering in Kyushu Institute of Technology	732
<i>K. Toyoda, M. Iwata, M. Cho</i>	
Dependence of sustained arc formation on charging environment of satellite solar array	736
<i>Tomoki Kitamura, Yuya Sanmaru, Takashi Kawasaki, Satoshi Hosoda, Kazuhiro Toyoda, Mengu Cho</i>	
Discharge phenomenon on solar array surface due to RF irradiation.....	740
<i>Kohei Kasedo, Satoshi Hosoda, Kazuhiro Toyoda, Mengu Cho, Yasumasa Hisada</i>	

Table of Contents

Basic experiment on charging mitigation of solar array in geostationary orbit environment.....	744
<i>Yuya Sanmaru, Takayuki Ose, Takashi Kawasaki, Yoshio Sikata, Satoshi Hosoda, Minoru Iwata, Kazuhiro Toyoda, Mengu Cho, Tatsuhito Fujita</i>	
Emission Spectral Analysis of Arc Plasma on Solar Array in GEO Environment	748
<i>Takayuki Ose, Yuya Sanmaru, Tomoki Kitamura, Satoshi Hosoda, Kazuhiro Toyoda, Mengu Cho</i>	
Surface Flashover on Printed Circuit Boards in Vacuum under Electron Beam Irradiation	752
<i>H. Fujii, I. Kanja, T. Hasegawa, H. Osuga, K. Matsui</i>	
Development of a Plasma Source for a Vacuum Arc Thruster Controlled by a Microcontroller	756
<i>S. Shibata, T. Yanagidaira, K. Tsuruta</i>	
Preliminary Study on Arc Welding in Vacuum	760
<i>H. Toya, K. Hieda, T. Saitou</i>	
High Specific Impulse Microwave Discharge Ion Engine for Interplanetary Explorer	764
<i>H. Hayashi, M. Cho, H. Kuninaka</i>	
Secondary Electron Emission Measurement of Insulating Materials for Spacecraft	768
<i>Hiroaki MIYAKE, Kumi NITTA, Shinichiro MICHIZONO, Yoshio SAITO</i>	
Localized and Delocalized Features of Microscopic Work Functions.....	772
<i>M. Sasaki, S. Yamamoto</i>	
Ballistic Field Electron Emission from Demountable Single Atom Tip	778
<i>E. Rokuta, T. Itagaki, K. Nomura, T. Ishikawa, B.L. Cho, H.-S. Kuo, I.-W. Hwang, T.T. Tsong, C. Oshima</i>	
A resonance gas desorption as an initiating factor of the vacuum insulation damage	782
<i>N.V. Tatarinova</i>	
Surface Electric Field Analysis of Insulating Material with Transitional Permittivity in Vacuum	786
<i>Kui Ma, Guan-Jun Zhang, Wen-Bin Zhao, Nan Zheng</i>	
A surface resistance effect on the fabrication of Dye-sensitized Solar Cell with various widths	790
<i>Jin-Young Choi, Ji-Tae Hong, Mi-Jeong Kim, Ji-Young Sim, Youl-Moon Sung, Hee-Je Kim</i>	
The New Design of Dye-Sensitized Solar Cell Adopted by Sputter Deposition of Counter Electrode	794
<i>Hee-Je Kim, Yong-Chul Kim, Im-Geun Lee, Ji-Tae Hong, Dong-Yoon Lee, Jin-Young Choi</i>	
Surface Treatment of TiO₂ Films by 4kHz Pulse Plasma for Dye-Sensitized Solar Cells Applications.....	798
<i>Toshifumi Yuji, Youl-Moon Sung</i>	
Titanium Materials for UHV/XHV Systems	802
<i>K. Ishizawa, H. Kurisu, S. Yamamoto, M. Matsuura, T. Nomura, N. Murashige, T. Morimoto, M. Hesaka</i>	
Nanometer-scale Distributions of Field Emission Current Measured with Scanning Tunneling Microscopy	806
<i>T. Sato, M. Saida, M. Nagao, S. Yamamoto, M. Sasaki</i>	
Glass capillary optics for focusing of high energy ion beams	810
<i>T. Nebiki, T. Narusawa</i>	
Effect of Thin Aluminum Layer on Fabricating Silicon Micro Cone Structures.....	814
<i>Hiroaki Yoshimura, Hiroaki Kanakusa, Kazuki Nakazawa, Akimitsu Hatta</i>	
Electric Discharge Suppression by Outgassing Reduction from Kicker Magnet of J-PARC RCS.....	818
<i>J. Kamiya, M. Kinsho, N. Ogiwara</i>	
Influence of vacuum heat treatment to the breakdown characteristic and the field electron emission characteristic of oxygen-free copper electrodes after spark conditioning	822
<i>Hiroyuki Ozawa, Yasushi Yamano, Shinichi Kobayashi, Yoshio Saito</i>	
Analysis of Several-keV Electron Stimulated Desorption Gases from Oxygen-free Copper Electrode with a Directional Quadrupole Mass Spectrometer	826
<i>Yuki Sekimori, Yasushi Yamano, Shinichi Kobayashi, Yoshio Saito</i>	

Table of Contents

Surface Electroluminescence Phenomena from Polymer under AC Voltage	830
<i>Kai Yang, Guan-Jun Zhang, Wen-Bin Zhao, Zhang Yan</i>	
Electron Emitters for Flat Panel Displays	834
<i>H. E. Bishop</i>	
Microplasma Discharge Using Carbon Nanotubes for Cathode	838
<i>Q. Zou, T. Ishibashi, H. Ohi, K. Nakazawa, H. Kanakusa, A. Hatta</i>	
Development of an active-matrix "HEED" cold cathode and its application to an image sensor	842
<i>Ryota Tanaka, Yohei Matsuba, Tomonari Nakada, Kazuto Sakemura, Nobuyasu Negishi, Yoshiyuki Okuda, Hideo Sato, Atsushi Watanabe, Takamasa Yoshikawa, Kiyohide Ogasawara, Masakazu Namba, Saburo Okazaki, Kenkichi Tanioka, Norifumi Egami</i>	
Fabrication of Novel Graphite Field Emitters and their Application to an Electron Beam Pumped Light Sources	846
<i>K. Shiozawa, Y. Neo, M. Okada, H. Kume, T. Matsumoto, T. Ikeda, M. Takahashi, G. Hashiguchi, H. Mimura</i>	
Precise control of field emission current by a built-in poly-Si thin film transistor	850
<i>M. Nagao, C. Yasumuro, S. Kanemaru, J. Itoh</i>	
Pressure Distribution and Pumping Delay Time in Short-Spacing Parallel Planes.....	854
<i>Y. Saito, Y. Sato, N. Matuda</i>	
Emission Characteristics of Graphite Nanofiber Field Emitter for FED	858
<i>USHIROZAWA Mizumoto, HAGIWARA Kei, YAMAMOTO Toshihiro, YOKOO Kuniyoshi</i>	
Electron emission properties of plasma treated silicon field emission arrays in gaseous ambient	862
<i>Y. Gotoh, T. Kojima, A. Oowada, M. Nagao, H. Tsuji, J. Ishikawa, S. Sakai</i>	
Bright Electron Beam from Graphite Nano-needle Cold Cathodes and Their Applications to Electron Beam Devices.....	866
<i>T. Matsumoto, Y. Neo, H. Kume, H. Mimura</i>	
Flat Panel Display Using Carbon Nanotube.....	868
<i>Jongmin Kima, Yongwan Jina, Intaeck Hana, Deokhyeon Choeb</i>	
Advances in Field Emission Displays	870
<i>Masayuki Nakamoto</i>	
Current Status of the Spindt-type Field Emitter	874
<i>Shigeo Itoh</i>	
The Role of Hop and Flue Plates in Flat Panel Displays	876
<i>H. E. Bishop</i>	