

# **Proceedings of the 26th International Electric Propulsion Conference**

**Kitakyushu International Conference Center  
Kokura-kita, Kitakyushu, 802-0001 Japan  
October 17-21, 1999**

**VOLUME II**

## VOLUME 2

### IEPC-99-127

#### Physic-Mathematics Model of a Self-Heated Hollow Cathode Electric Discharge

Evolution ..... 714

S. A. Lobov, A.V. Loyan, *Kharkov Aviation Institute, Ukraine.*

### IEPC-99-128

Heat Balance in a Neutralizer Cathode of Stationary Plasma Thruster (SPT) ..... 720

B. Arhipov, *DB Fakel, Russia.*

### IEPC-99-131

Researching of Running-In, Starting, Transition Thermal Processes of Self-Heated Hollow Cathode in Electric Current Range from 5 up to 25A..... 727

S. A. Lobov, A. V. Loyan, *Kharkov Aviation Institute, Ukraine.*

### IEPC-99-133

The Compatibility of Hollow Cathode Characteristics with a Variety of Ion Thruster

Designs ..... 732

D. G. Fearn, *DERA, UK*, S. W. Patterson, *Imperial College, UK.*

### IEPC-99-135

Investigation of Self-Heated Hollow Cathodes Operation Possibility in Water Moist Stream of High-Pressure Condition ..... 740

N. N. Koshelev, A. V. Loyan, *Kharkov Aviation Institute, Ukraine*, V. P. Sklarov, A. A. Tarelin, *Machine Problems Institute of Ukrainian Engineer Sciences Academy, Ukraine.*

### IEPC-99-137

Experimental Investigation of a Gas Propellant Consumption Oscillation When Self-Heated Hollow Cathode is Starting from Cold State ..... 744

N. N. Koshelev, S. A. Lobov, A. V. Loyan, *Kharkov Aviation Institute, Ukraine.*

### IEPC-99-138

Analyze of Gas Propellant Consumption Oscillation When the Self-Heated Hollow Cathode is Starting "Cold" State ..... 747

A. V. Loyan, *Kharkov Aviation Institute, Ukraine.*

### IEPC-99-139

Development Status of a Microwave Ion Engine System for the MUSES-C Mission ..... 753

K. Toki, H. Kuninaka, I. Funaki, K. Nishiyama, Y. Shimizu, *ISAS, Japan.*

### IEPC-99-140

Development of an RF-Ion Thruster for Commercial Application ..... 761

R. Killinger, H. Bassner, H. Müller, *Daimler Crysler Aerospace AG, Germany.*

### IEPC-99-141

Role of Magnetic Field in Kaufman Type Electrostatic Ion Thrusters ..... 767

A.K. Malik, *Imperial College, UK.*

<b>IEPC-99-142</b>	
<b>1000-Hour Test of a 35-cm Diameter Xenon Ion Thruster .....</b>	<b>774</b>
S. Kitamura, Y. Hayakawa, K. Miyazaki, <i>NAL, Japan</i> , H. Yoshida, Y. Yamamoto, K. Akai, <i>Toshiba Corporation, Japan</i> .	
<b>IEPC-99-143</b>	
<b>A Xenon Propellant Management sub-Unit for Ion Propulsion .....</b>	<b>782</b>
K. Dyer, <i>VACCO Industries, USA</i> , A. Dien, <i>Stanford Mu Space Corporation, USA</i> , M. Ikeda, K. Kajiwarra, <i>NASDA, Japan</i> , E. Nishida, Y. Kasai, <i>MELCO, Japan</i> .	
<b>IEPC-99-144</b>	
<b>Beam Intensity Distribution of a Ring-Cusp Ion Thruster .....</b>	<b>789</b>
H. Yoshida, Y. Yamamoto, K. Akai, <i>Toshiba Corporation, Japan</i> , Y. Hayakawa, K. Miyazaki, S. Kitamura, <i>NAL, Japan</i> .	
<b>IEPC-99-145</b>	
<b>Ion Thruster Lifetime Estimation and Modeling Using Computer Simulation .....</b>	<b>797</b>
M. Nakano, <i>Kyushu Institute of Technology, Japan</i> , Y. Arakawa, <i>University of Tokyo, Japan</i> .	
<b>IEPC-99-146</b>	
<b>Particle Simulation on Ion Beam Extraction Phenomena in an Ion Thruster .....</b>	<b>805</b>
Y. Okawa, H. Takegahara, <i>Tokyo Metropolitan Institute of Technology, Japan</i> .	
<b>IEPC-99-147</b>	
<b>Validation of a Grid Erosion Simulation by Short-Time Erosion Measurements.....</b>	<b>813</b>
M. Tartz, E. Hartmann, R. Deltschew, H. Neumann, <i>Institut für Oberflächenmodifizierung e.V., Germany</i> .	
<b>IEPC-99-148</b>	
<b>Application of Amorphous-Carbon Grids to an Ion Thruster .....</b>	<b>819</b>
H. Satow, H. Takegahara, <i>Tokyo Metropolitan Institute of Technology, Japan</i> , T. Tachibana, <i>Kyushu Institute of Technology, Japan</i> , K. Kawata, <i>Astec Irie Corporation, Japan</i> .	
<b>IEPC-99-149</b>	
<b>Titanium Optics for Ion Thrusters .....</b>	<b>825</b>
G. C. Soulas, <i>Dynacs Engineering Co., Inc., USA</i> , T. W. Haag, M. J. Patterson, V. K. Rawlin, <i>NASA Glenn Research Center, USA</i> .	
<b>IEPC-99-150</b>	
<b>Simulation of Electromagnetic Interference Induced by Ion Thruster Plume .....</b>	<b>839</b>
M. Kajikawa, M. Cho, <i>Kyushu Institute of Technology, Japan</i> .	
<b>IEPC-99-151</b>	
<b>Deep Space One Investigations of Ion Propulsion Plasma Environment: Initial Results.....</b>	<b>845</b>
J. Wang, D. E. Brinza, J. E. Polk, M. D. Hernry, <i>JPL, California Institute of Technology, USA</i> .	

**IEPC-99-153**

- Improvement of 20mN Xenon Ion Thruster ..... 853**  
T. Ozaki, Y. Kasai, E. Nishida, *MELCO, Japan*.

**IEPC-99-154**

- Performance Improvement of Radiofrequency Ion Thrusters - The Evolution of the RIT 15 Ion Engine ..... 861**  
H. J. Leiter, H. W. Löb, K-H. Schartner, *Giessen University, Germany*.

**IEPC-99-156**

- C<sub>60</sub> Plasma and Ion Beam Diagnostics in an Electron Bombardment Ion Thruster ..... 869**  
S. Sugaya, Y. Nakayama, H. Takegahara, *Tokyo Metropolitan Institute of Technology, Japan*.

**IEPC-99-157**

- Plasma Properties around the Baffle Aperture Region of the UK25 Ion Thruster ..... 877**  
D. J. Milligan, S. B. Gabriel, *University of Southampton, UK*.

**IEPC-99-158**

- Development and Performance Testing of an RF-Ion Thruster for Primary Propulsion ..... 885**  
H. Bassner, *Daimler Chrysler Aerospace AG, Germany*, R. Bond, V. Thompson, *AEA Technology plc, UK*, H-P. Harmann, K. Groh, *Giessen University, Germany*.

**IEPC-99-159**

- Enhanced Discharge Performance in a Ring-Cusp Plasma Source ..... 894**  
J. E. Foster, M. J. Patterson, *NASA Glenn Research Center, USA*.

**IEPC-99-160**

- Electron Emission Mechanism of Microwave Discharge Neutralizer ..... 902**  
N. Onodera, H. Takegahara, *Tokyo Metropolitan Institute of Technology, Japan*, K. Nishiyama, I. Funaki, H. Kuninaka, *ISAS, Japan*.

**IEPC-99-162**

- Numerical Modeling of Extraction Systems in Ion Thrusters ..... 910**  
V. A. Muravlev, A. A. Shagayda, *Keldysh Research Center, Russia*.

**IEPC-99-163**

- Investigation of Near-Cathode Area of 5-cm Ion Thruster: A Current State of Work ..... 918**  
O. A. Gorshkov, M. V. Zikeyev, *Keldysh Research Center, Russia*.

**IEPC-99-164**

- Verification Tests of 10-cm-diam. Carbon-Carbon Composite Grids for Microwave Discharge Ion Thruster ..... 925**  
I. Funaki, H. Kuninaka, Y. Shimizu, K. Toki, S. Satori, K. Nishiyama, *ISAS, Japan*.

<b>IEPC-99-165</b>	
<b>Scaling Law Applicable to Design of MPD Arcjet .....</b>	<b>933</b>
<i>Y. Shimizu, ISAS, Japan, K. Kuriki, Tokyo Metropolitan Institute of Technology, Japan</i>	
<b>IEPC-99-166</b>	
<b>Thermal Analysis of a Lorentz Force Accelerator with an Open Lithium Heat .....</b>	<b>941</b>
<i>G. Emsellem, A. D. Kodys, E. Y. Choueiri, Princeton University, USA.</i>	
<b>IEPC-99-167</b>	
<b>Characterisation of a Steady State MPD-Thruster with a Radiation Cooled Anode .....</b>	<b>949</b>
<i>M. Winter, M. Auweter-Kurtz, C. Boie, J. Heiermann, H. L. Kurtz, Stuttgart University, Germany.</i>	
<b>IEPC-99-168</b>	
<b>Numerical Study of Onset Phenomena in a 2-Dimensional Axisymmetric MPD Thruster ....</b>	<b>957</b>
<i>T. Miyasaka, T. Fujiwara, Nagoya University, Japan</i>	
<b>IEPC-99-169</b>	
<b>Recent Improvements of Numerical Methods for the Simulation of MPD Thruster Flow on Adaptive Meshes .....</b>	<b>964</b>
<i>J. Heiermann, M. Auweter-Kurtz, H. J. Kaeppler, Stuttgart University, Germany, A. Eberle, Daimler Chrysler Aerospace AG, Germany, U. Iben, Robert Bosch GmbH, Germany, P. C. Sleziona, University of Kaiserslautern, Germany.</i>	
<b>IEPC-99-170</b>	
<b>Low Temperature Cathode Operation: a Spot Model - Part I .....</b>	<b>970</b>
<i>P. Rossetti, F. Paganucci, M. Andrenucci, Centropazio, Italy.</i>	
<b>IEPC-99-171</b>	
<b>One-Dimensional Numerical Simulation of Two-Fluid Nonequilibrium Plasma Flow in MPD Thrusters .....</b>	<b>978</b>
<i>N. Fukuoka, T. Miyasaka, T. Fujiwara, Nagoya University, Japan.</i>	
<b>IEPC-99-172</b>	
<b>Electrode Power Loss and Thruster Performance of a Pulsed MPD Accelerator .....</b>	<b>985</b>
<i>Y. Kagaya, H. Tahara, T. Yoshikawa, Osaka University, Japan.</i>	
<b>IEPC-99-173</b>	
<b>Cathode Jet of Magnetoplasmadynamic Thrusters .....</b>	<b>992</b>
<i>K. Mitsuo, H. Tahara, H. Hamano, Y. Kagaya, T. Yoshikawa, Osaka University, Japan.</i>	
<b>IEPC-99-174</b>	
<b>Temperature and Material Effects on the Operation of MPD Cathodes .....</b>	<b>1000</b>
<i>F. Paganucci, P. Rossetti, M. Andrenucci, Centropazio, Italy.</i>	

**IEPC-99-175****Supersonic Plasma Flow in a Magnetic Nozzle ..... 1010**

M. Inutake, K. Hattori, A. Ando, F. Hori, T. Sugimura, K. Fukushi, T. Ochiai, M. Yamamoto, A. Imasaki, M. Yoshinuma, *Tohoku University, Japan*.

**IEPC-99-176****Own Magnetic Field Impact on MPD Thrusters Performance with External Magnetic Field ..... 1017**

V. B. Tikhonov, S. A. Semenikhin, *RIAME-MAI, Russia*, J. E. Polk, *JPL, USA*.

**IEPC-99-177****Numerical Analyses of MHD Flows in an Applied-Field MPD Arcjet Thruster ..... 1024**

H. Katsurayama, T. Miyasaka, T. Fujiwara, *Nagoya University, Japan*.

**IEPC-99-179****Arc Structure in a Coaxial Magnetoplasmdynamic Channel ..... 1032**

K. Mitsuo, H. Tahara, T. Kimura, Y. Kagaya, T. Yoshikawa, *Osaka University, Japan*.

**IEPC-99-180****Mach-Probe Characteristics in a Magnetized Plasma Flow ..... 1040**

A. Ando, K. Hattori, M. Inutake, T. Sugimura, F. Hori, K. Fukushi, T. Ochiai, M. Yamamoto, A. Imasaki, M. Yoshinuma, *Tohoku University, Japan*.

**IEPC-99-181****Design of a Solar Electric Propulsion Transfer Vehicle for a Non-Nuclear Human Mars Exploration Architecture ..... 1046**

L. A. Dudzinski, K. J. Hack, L. P. Gefert, T. W. Kerslake, A. W. Hewston, *NASA Glenn Research Center, USA*.

**IEPC-99-182****An Overview of the On-Orbit Results from the Electric Propulsion Space Experiment (ESEX) ..... 1056**

D. R. Bromaghim, J. R. LeDuc, R. M. Salasovich, A. M. Sutton, J. A. Zimmerman, D. C. Matias, A. M. Sutton, G. G. Spanjers, J. M. Fife, W. A. Hargus, R. A. Spores, *US Air Force Research Laboratory, USA*, M. J. Dulligan, S. F. Engelman, *ECR, Inc., USA*, J. H. Schilling, D. C. White, *W. E. Research, LLC, USA*, L. K. Johnson, *The Aerospace Corporation, USA*.

**IEPC-99-183****Torque Control of Hall Propelled Small Spacecraft ..... 1070**

J. Ashkenazy, G. Appelbaum, *Soreq NRC, Israel*, M. Guelman, A. Kogan, *Israel Institute of Technology, Israel*.

**IEPC-99-185****Advanced Electric Propulsion for RLV Launched Geosynchronous Spacecraft ..... 1076**

S. R. Oleson, *NASA Glenn Research Center, USA*.

<b>IEPC-99-186</b>	
<b>Feasibility Study of Nanosatellite Based on Commercial Technology .....</b>	<b>1085</b>
S. Satori, <i>Hokkaido Institute of Technology, Japan</i> , H. Okamoto, <i>Astro Research Company, Japan</i> , S. Nakasuka, <i>University of Tokyo, Japan</i> , M. Suzuki, M. Sasaki, R. Mitsuhashi, S. Takezawa, <i>Hokkaido Institute of Technology, Japan</i> , N. Sako, <i>University of Tokyo</i> , T. Ishikawa, A. Nagata, <i>Hokkaido Institute of Technology, Japan</i> , I. Funaki, <i>ISAS, Japan</i> .	
<b>IEPC-99-187</b>	
<b>Two New Spacecraft Architectures and Their Impacts on Electric Propulsion .....</b>	<b>1091</b>
S. Nakasuka, Y. Tsuda, T. Ejima, <i>University of Tokyo, Japan</i> , Y. Kawakatsu, R. Nagashima, <i>NASDA, Japan</i> .	
<b>IEPC-99-188</b>	
<b>A Method of Placing a Spacecraft on High Orbit .....</b>	<b>1099</b>
V. N. Vinogradov, V. M. Murashko, A. G. Nattyin, <i>DB Fakel, Russia</i> .	
<b>IEPC-99-189</b>	
<b>Very Long Range Exploration by Means of Electric Propulsion and Cometary Resource Utilization .....</b>	<b>1107</b>
P. J. Turchi, C. A. Scharlemann, <i>Ohio State University, USA</i> .	
<b>IEPC-99-190</b>	
<b>The Preliminary Study on the Effective Utilization of a Lunar-Derived Propellant (LOX) .....</b>	<b>1115</b>
R. Nagashima, <i>NASDA, Japan</i> , S. Nakasuka, <i>University of Tokyo, Japan</i> , Y. Kawakatsu, T. Yokoyama, <i>NASDA, Japan</i> .	
<b>IEPC-99-191</b>	
<b>Application of DC Arcjet for Low Earth Orbit Spacecraft .....</b>	<b>1124</b>
Y. Kunii, <i>MELCO, Japan</i> , K. Toki, <i>ISAS, Japan</i> .	
<b>IEPC-99-192</b>	
<b>Pulsed Plasma Thrusters for Spacecraft Attitude and Orbit Control System .....</b>	<b>1129</b>
N. N. Antropov, G. A. Diakonov, V. Kim, G. A. Popov, A. I. Pokryshkin, <i>RIAME-MAI, Russia</i> , M. N. Kazeev, <i>Kurchatov Institute, Russia</i> , V. P. Khodnenko, <i>All-Russian Research Institute of Electro-mechanics, Russia</i> .	
<b>IEPC-99-194</b>	
<b>Evaluation of Electrodynamic Tether Propulsion to OTV .....</b>	<b>1136</b>
M. Kozakai, H. Takegahara, <i>Tokyo Metropolitan Institute of Technology, Japan</i> , Y. Yamagiwa, R. Tuyuki, <i>Shizuoka University, Japan</i> , R. Yasumitsu, <i>University of Tokyo</i> , A. Nakajima, <i>NAL, Japan</i> .	
<b>IEPC-99-195</b>	
<b>Non-Chemical Propulsion Abilities for Near-Earth Missions .....</b>	<b>1142</b>
V. A. Nevrovsky, <i>Moscow State University of Aircraft Technology, Russia</i> .	

**IEPC-99-196****Nitrating by MPD Thruster - Is the Ecological Clean Alternative to Chemical – Thermal****Methods of Strengthening ..... 1150**N.V. Bilan, A. V. Loyan, S. V. Muchin, O. P. Rubalov, *Kharkov Aviation Institute, Ukraine***IEPC-99-197****Development of an Electromagnetic Acceleration Plasma Generator for Zirconia and Titanium****Nitride Coatings ..... 1153**T. Shibata, H. Tahara, T. Yasui, Y. Kagaya, T. Yoshikawa, *Osaka University, Japan.***IEPC-99-198****High Temperature Plasma Furnace Using Gas Tunnel Type Plasma Jet and Its Application to Surface Modification ..... 1159**A. Kobayashi, *Osaka University, Japan.***IEPC-99-199****Development of 30-cm Long Linear Sputtering Source Using ECR Discharge ..... 1165**T. Yasui, T. Matsumoto, H. Tahara, T. Yoshikawa, *Osaka University, Japan.***IEPC-99-201****Effects of Addition of Hydrogen to Nitrogen Plasma during Nitriding of Titanium and****SACM645 Steel Using Supersonic Expanding Nitrogen Plasma Jets ..... 1171**Y. Ando, S. Tobe, *Ashikaga Institute of Technology, Japan*, H. Tahara, T. Yoshikawa, *Osaka University, Japan.***IEPC-99-202****Development of Large Size Ion Source for Ion Shower Doping ..... 1177**H. Kuwabara, I. Nakamoto, Y. Kawasaki, *Ishikawajima-Harima Heavy Industries Co. Ltd., Japan.***IEPC-99-203****A Study of Pulsed Plasma Accelerator with Metal Propellant for Space and Technology****Application..... 1182**L. N. Lesnevskiy, V. N. Tyurine, *MAI, Russia.***IEPC-99-205****Quantitative Radiation Measurements of the Pulsed Plasma Microthruster ..... 1190**T. Umeki, P. J. Turchi, *Ohio State University, USA.***IEPC-99-206****Visualization of Current Sheet Canting in a Pulsed Plasma Accelerators ..... 1196**T. E. Markusic, E. Y. Choueiri, *Princeton University, USA.***IEPC-99-207****Performance Study of High Power Ablative Pulsed Plasma Thruster ..... 1204**Y. A. Alexeev, M. N. Kazeev, *Kurchatov Institute, Russia.*



<b>IEPC-99-208</b>	
<b>An Accurate Characteristic-Splitting Scheme for Numerical Simulation of MHD Equations .....</b>	
	<b>1210</b>
K. Sankaran, E. Y. Choueiri, <i>Princeton University, USA.</i>	
<b>IEPC-99-209</b>	
<b>Comparing the Performance of Coaxial and Parallel Plate Gas-Fed PPTs .....</b>	
	<b>1217</b>
J. K. Ziemer, E. Y. Choueiri, <i>Princeton University, USA</i> , D. Birx, <i>Science Research Laboratory Inc., USA.</i>	
<b>IEPC-99-210</b>	
<b>Design, Operation, and Investigation of an Inductively-Driven, Coaxial Pulsed Plasma Microthruster .....</b>	
	<b>1225</b>
H. Kamhawi, P. J. Turchi, I. G. Mikellides, P. G. Mikellides, <i>Ohio State University, USA.</i>	
<b>IEPC-99-211</b>	
<b>Optimization of Pulsed Plasma Thrusters in Rectangular and Coaxial Geometries .....</b>	
	<b>1232</b>
I. G. Mikellides, P. J. Turchi, <i>Ohio State University, USA.</i>	
<b>IEPC-99-213</b>	
<b>Particulate Interaction with Plasma in a Pulsed Plasma Thruster .....</b>	
	<b>1240</b>
M. Keidar, I. D. Boyd, <i>University of Michigan, USA</i> , I. I. Beilis, <i>Tel Aviv University, Israel.</i>	
<b>IEPC-99-214</b>	
<b>A Model of an Electrical Discharge in a Co-Axial Pulsed Plasma Thruster .....</b>	
	<b>1248</b>
M. Keidar, I. D. Boyd, <i>University of Michigan, USA</i> , I. I. Beilis, <i>Tel Aviv University, Israel.</i>	
<b>IEPC-99-216</b>	
<b>Plasma and Field Response to High Potential System in Space .....</b>	
	<b>1256</b>
H. Usui, H. Matsumoto, Y. Omura, <i>Kyoto University, Japan.</i>	
<b>IEPC-99-217</b>	
<b>Computation of Current to a Moving Bare Tether .....</b>	
	<b>1262</b>
T. Onishi, M. Martinez-Sanchez, <i>MIT, USA</i> , D. L. Cooke, <i>Air Force Research Laboratory, USA.</i>	
<b>IEPC-99-218</b>	
<b>Hollow-Cathode Plasma-Contacting Insights Gained from the Electrodynamic Tether Mission .....</b>	
	<b>1269</b>
P. J. Wilbur, D. Burtner, <i>Colorado State University, USA.</i>	
<b>IEPC-99-219</b>	
<b>Performance of Electrodynamic Tether Orbit Transfer System with Consideration of Lifetime by the Impact of Debris .....</b>	
	<b>1277</b>
Y. Yamagiwa, Y. Sakata, T. Hashimoto, <i>Shizuoka University, Japan.</i>	

<b>IEPC-99-220</b>	
<b>System Considerations of Electrodynamic-Tether Propulsion Technology and Future Plans .....</b>	<b>1284</b>
B. E. Gilchrist, University of Michigan, USA, L. Johnson, NASA Marshall Space Flight Center, S. G. Bilén, University of Michigan, USA, E. C. Lorenzini, Harvard-Smithsonian Center for Astrophysics, USA, N. R. Voronka, University of Michigan, USA.	
<b>IEPC-99-221</b>	
<b>Comparison Between Plasma Plume Theoretical Model and Experimental Data .....</b>	<b>1291</b>
A. G. Korsun, B. S. Borisov, E. M. Tverdokhlebova, F. F. Gabdullin, <i>TsNIIMASH, Russia</i> .	
<b>IEPC-99-222</b>	
<b>The Reaction Yield of Graphite with Hyperthermal Atomic Oxygen in a Low Earth Orbital Space Environment .....</b>	<b>1303</b>
H. Kinoshita, M. Umeno, <i>Osaka University, Japan</i> , M. Tagawa, N. Ohmae, <i>Kobe University, Japan</i> .	
<b>IEPC-99-223</b>	
<b>Experimental Determination of Sputtering Coefficients - ISP Software: Numerical Calculation of Material Erosion .....</b>	<b>1310</b>
I. Jouin, V. Perrin, D. Borie, <i>Alcatel Space Industries, France</i> , V. Huchet, <i>Teuchos PACA, France</i> , S. Khartov, A. Nadiradze, I. Shkarban, A. Semenov, A. Chirov, <i>MAI, Russia</i> .	
<b>IEPC-99-224</b>	
<b>Ground Experiments of Interaction Between Plasma Flow and Negatively Biased or Charged Materials .....</b>	<b>1314</b>
D. Matsuyama, H. Tahara, T. Matsuda, T. Yasui, T. Yoshikawa, <i>Osaka University, Japan</i> .	
<b>IEPC-99-226</b>	
<b>Plume Measurement of Plasma Propulsion System .....</b>	<b>1322</b>
T. Noutsuka, Y. Takao, T. Hida, Y. Yano, G. Kantou, K. Uemura, H. Nakashima, <i>Kyushu University, Japan</i> .	
<b>IEPC-99-227</b>	
<b>ICRF Wave Propagation and Absorption in a Micro Wave Discharge Ion Thruster .....</b>	<b>1329</b>
Y. Mori, Y. Takao, H. Nakashima, <i>Kyushu University, Japan</i> .	
<b>IEPC-99-228</b>	
<b>Interaction between Plasma Plume of Electric Propulsion and Spacecraft Communication .....</b>	<b>1336</b>
N. Onodera, H. Takegahara, <i>Tokyo Metropolitan Institute of Technology, Japan</i> , I. Funaki, H. Kuninaka, <i>ISAS, Japan</i> .	
<b>IEPC-99-229</b>	
<b>Mathematical Modeling of the Electric Propulsion Plasma Plume Interaction with Spacecraft Radiotechnical Systems .....</b>	<b>1344</b>
I. P. Kozlov, <i>RIAME-MAI, Russia</i> .	

**IEPC-99-230**

- Optical Measurement of Charging and Discharging Processes on Insulator Surface in Simulated Low Earth Orbit Plasma Environment ..... 1351**  
K. Shiraishi, M. Cho, M. Hikita, Kyushu Institute of Technology, Japan.

**IEPC-99-232**

- Contamination Sensor for Electric Propulsion and Solid Rocket Motor ..... 1356**  
K. Nishiyama, I. Funaki, H. Kuninaka, *ISAS, Japan*.

**IEPC-99-233**

- ISAS High Enthalpy Flow Facility for Thermal Protection Material Tests..... 1362**  
T. Yamada, N. Suzuki, Y. Inatani, *ISAS, Japan*.

**IEPC-99-235**

- Experimental Analysis of a Solid Propellant MPD Thruster with Different Anode Radii ..... 1370**  
G. Paccani, L. Petrucci, *Universita Studi di Roma "La Sapienza", Italy*, W. D. Deininger, *Ball Aerospace & Technologies Corporation, USA*.

**IEPC-99-238**

- Preliminary Development Status of the IUA's P4S-1 Ablative Pulsed Plasma Thruster ..... 1378**  
H. H. Brito, R. O. De Alessandro, C. A. Dominguez, *Instituto Universitario Aeronautico, Argentina*.

**IEPC-99-241**

- Microwave Telemetry Breakdown Caused by Rocket Plume ..... 1386**  
T. Abe, K. Fujita, H. Ogawa, K. Funaki, *ISAS, Japan*.

**IEPC-99-242**

- A Model for the Characterization of Plasma Inside the Stationary Plasma Thruster ..... 1392**  
K. Makowski, Z. Peradzynski, S. barral, *IPPT-PAN, Poland*, M. Dudeck, *CNRS, France*.

**IEPC-99-244**

- Design and Manufacture of the ETS VIII Composite Overwrapped Xenon Pressure Vessel ..... 1397**  
W. H. Tam, *Pressure Systems, Inc., USA*, M. D. Drey, A. C. Jackson, *Programmed Composites, Inc., USA*, E. Nishida, Y. Kasai, *MELCO, Japan*, A. Tsujihata, K. Kajiware, *NASDA, Japan*.

**IEPC-99-245**

- Parametric Investigations of Segmented Electrode Hall Thruster ..... 1412**  
Y. Raitses, L. A. Dorf, A. A. Litvak, N. J. Fisch, *Princeton University, USA*.