

# **40th AIAA Plasmadynamics and Lasers Conference 2009**

**San Antonio, Texas, USA  
22 – 25 June 2009**

**ISBN: 978-1-61567-353-7**

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers.  
Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at  
1801 Alexander Bell Drive, Reston, VA 20191, USA.

## TABLE OF CONTENTS

<b>Supersonic Drag Reduction with Repetitive Laser Pulses Through a Blunt Body.....</b>	1
<i>A. Sasoh, T. Sakai, Y. Sekiya, A. Matsuda, J. Kim</i>	
<b>Unsteadiness Effects at a Pulsed-Periodic Energy Supply to Supersonic Flow .....</b>	11
<i>V. Zudov, P. Tretyakov, A. Tupikin</i>	
<b>Laser Ablation: Beam Wavelength Optimization and Communication through Plasma.....</b>	24
<i>M. Kundrapu, M. Keidar</i>	
<b>Calculation of Pulsed Laser-Ablative Impulse on Polyacetal.....</b>	35
<i>T. Sakai, K. Ichihashi, A. Matsuda, A. Sasoh</i>	
<b>Energy Coupling and Heat Release in Air and Ethylene-Air Nanosecond Pulse Discharge Plasmas.....</b>	44
<i>I. Choi, M. Uddi, Y. Zuzeek, S. Bowman, I. Adamovich, W. Lempert</i>	
<b>Ignition and Flameholding of Premixed and Non-premixed Ethylene-Air Flows by a Repetitively Pulsed Nanosecond Discharge .....</b>	75
<i>A. Dutta, E. Mintusov, A. Erofeev, I. Adamovich</i>	
<b>Investigations of the Rapid Plasma Chemistry Induced by Nanosecond Discharges in Atmospheric Pressure Air Using Advanced Optical Diagnostics .....</b>	94
<i>G. Stancu, F. Kaddouri, D. Lacoste, C. Laux</i>	
<b>Computational Simulation of Nanosecond Pulsed Plasma Assisted Ignition of a Supersonic Fuel-Oxidizer Stream.....</b>	101
<i>D. Breden, S. Mahadevan, L. Raja</i>	
<b>Laser Flash-Photolysis and Gas Discharge in N<sub>2</sub>O-Containing Mixture: Kinetic Mechanism .....</b>	121
<i>S. Starikovskaia, I. Kosarev, N. Popov</i>	
<b>Experiments on Heat-Flux Mitigation by Electromagnetic Fields in Ionized Flows.....</b>	131
<i>A. Güllan, B. Esser, U. Koch, F. Siebe, D. Giordano, D. Konigorski</i>	
<b>Experimental Investigation on the MHD Interaction in a Hypersonic Flow Around a Blunt Body .....</b>	145
<i>A. Cristofolini, C. Borghi, G. Neretti, A. Passaro</i>	
<b>Rarefied Gas Effects on the Magnetic Flow Control System for Aerobraking Flight of the Reentry Vehicle .....</b>	155
<i>H. Otsu, H. Katsurayama, T. Abe, D. Konigorski</i>	
<b>Three Dimensional Simulations of Hypersonic MHD Flow Control .....</b>	164
<i>N. Bisek, I. Boyd, J. Poggie</i>	
<b>Numerical Modeling of Plasma Manipulation Using an ExB Layer in the Hypersonic Boundary Layer.....</b>	181
<i>M. Kim, M. Keidar, I. Boyd</i>	
<b>Progress in Modeling of Pre-ionization and Geometric Effects on a Field-Reversed Configuration Plasma Thruster .....</b>	201
<i>S. Miller, J. Rovey</i>	
<b>A Zero Dimensional Model of High-Pressure Ablative Capillary Discharge With Capillary Wall Thermal Conduction and Radiation Absorption .....</b>	206
<i>L. Pekker, O. Pekker</i>	
<b>Magnetohydrodynamic Simulation of Inductively Coupled CO<sub>2</sub> Plasma .....</b>	220
<i>N. Isozaki, T. Fujino, M. Ishikawa</i>	
<b>Optimization and Analysis of Performance Characteristics of Large-Scale TWDEC .....</b>	240
<i>K. Nara, D. Kawagoe, R. Kawana, M. Ishikawa</i>	
<b>Complex Flow Motions During Laser Welding.....</b>	250
<i>C. Zhao, I. Richardson</i>	
<b>Optimization of Seed Fraction and Performance Analysis for Commercial-Scale Faraday-Type MHD Generator .....</b>	257
<i>D. Narishige, T. Takahashi, T. Fujino, M. Ishikawa</i>	
<b>Performance Characteristics of Commercial Scale Disk MHD Generator With RF Plasma Production Technique .....</b>	269
<i>S. Komianami, T. Fujino, M. Ishikawa, Y. Okuno</i>	
<b>Computational Simulations of Power Extraction in MHD Channel .....</b>	287
<i>C. Merkle, T. Moeller, R. Rhodes, D. Keefer</i>	
<b>Numerical Investigation on Non-Uniformity in Channel Cross Section of Scramjet Driven Magnetohydrodynamic Power Generator .....</b>	303
<i>N. Harada, T. Narikawa, T. Kikuchi</i>	
<b>On Prospective of MHD Electrical Power Generator on Aluminum Hydrodation Products.....</b>	313
<i>A. Sheindlin, V. Bityurin, A. Bocharov, V. Miroshnichenko, P. Ivanov, V. Zalkind, A. Zhouk</i>	

<b>Three-Dimensional Analysis of a Small-Scale Hall Type MHD Generator With Circular Cross-Section.....</b>	320
<i>K. Mizumura, H. Ohkuma, T. Takahashi, T. Fujino, M. Ishikawa, J. Lineberry</i>	
<b>Experimental and Numerical Analysis of the Impact of a Strong Permanent Magnet on Argon Plasma Flow .....</b>	330
<i>A. Knapp, D. Haag, G. Herdrich, N. Ono, M. Fertig</i>	
<b>Investigation of a Magnetic Heat Flux Probe in Argon Plasma Flow .....</b>	340
<i>A. Knapp, S. Löhle, G. Herdrich, M. Auweter-Kurtz</i>	
<b>Generator Performance and Aerodynamic Characteristics of Space Vehicle Equipped With On-Board Surface Hall MHD Generator .....</b>	349
<i>Y. Takayama, T. Yoshino, T. Fujino, M. Ishikawa</i>	
<b>Compact Difference Methods for Discharge Modeling in Aerodynamics.....</b>	365
<i>J. Poggie</i>	
<b>High-Order Accurate Implicit Scheme for Drift-Diffusion Equations and Application to DBD Discharges .....</b>	380
<i>R. Arpa, D. D'Ambrosio</i>	
<b>Fully Coupled Maxwell/Navier-Stokes Simulation of Electromagnetic Hypersonics Including Accurate Transport Models.....</b>	397
<i>D. D'Ambrosio, D. Giordano, D. Bruno</i>	
<b>Solution of Maxwell's Equations Coupled to the Navier-Stokes Equations.....</b>	411
<i>R. MacCormack</i>	
<b>Computational Aspects of Magnetofluidynamics Formulations.....</b>	425
<i>O. Khan, K. Hoffmann</i>	
<b>Hypersonic Turbulent MHD Flow Using High-Order WENO Schemes.....</b>	436
<i>J. Lee, M. Huerta, G. Zha</i>	
<b>Measurements of Improved ElectricOIL Performance, Gain, and Laser Power .....</b>	453
<i>D. Carroll, G. Benavides, A. Palla, J. Zimmerman, B. Woodard, J. Verdeyen</i>	
<b>Experiments and Modeling of Supersonic COILs .....</b>	464
<i>S. Rosenwaks, I. Brami-Rosilio, K. Waichman, B. Barnashenko</i>	
<b>Scaling and Optimization of an Electric Discharge Excited Oxygen-Iodine Laser .....</b>	476
<i>J. Bruzzese, M. Nishihara, A. Cole, I. Adamovich</i>	
<b>Generation of I Atoms for Oxygen-Iodine Lasers Using RF Discharge Dissociation of Various I Donors.....</b>	490
<i>V. Jirasek, J. Schmiedberger, M. Censky, I. Pickova, J. Kodymova</i>	
<b>Recent Development of Hybrid DC/RF Plasma Jet Generator of O<sub>2</sub>(<sup>1</sup>Δ) for DOIL.....</b>	499
<i>J. Schmiedberger, K. Rohlenda, V. Jirásek, M. Censký, J. Kodymová, O. Špalek, J. Gregor, P. Krenek, M. Hrabovský, P. Filip</i>	
<b>Analysis and Optimization of Mixing Processes with LES: An Application to SCOIL .....</b>	508
<i>Y. Huai, S. Jia, Y. Jin</i>	
<b>Some Results of Dielectric Barrier Discharge Simulations Using the PIC Code (MAGIC) .....</b>	517
<i>M. Huerta, L. Ludeking</i>	
<b>Momentum Coupling and Flow Induction in a DBD Plasma Actuator .....</b>	532
<i>T. Abe, M. Takagaki</i>	
<b>Development and Characterization of Pulsed RF Localized Arc Filament Plasma Actuator Arrays for High Speed Flow Control.....</b>	540
<i>J. Kim, M. Nishihara, I. Adamovich, M. Samimy, S. Gorbatov, F. Pliavaka</i>	
<b>Large-Eddy Simulation of Pulsed Arc Discharges in Supersonic Flow.....</b>	564
<i>J. Schulz, S. Menon</i>	
<b>Surface HF Discharge in Airflow .....</b>	577
<i>A. Klimov, V. Bityrin, A. Bocharov, I. Moralev, B. Tolkunov, P. Kazansky</i>	
<b>Mixing Intensification in High-Speed Flow by Unstable Pulse Discharge .....</b>	587
<i>S. Leonov, Y. Isaenkov</i>	
<b>Aero-Optic Measurements Using a Laser-Induced Air Breakdown Beacon .....</b>	597
<i>M. Rennie, G. Cross, M. Whiteley, E. Jumper</i>	
<b>Numerical Simulation of Aero-Optical Distortions by a Turbulent Boundary Layer And Separated Shear Layer.....</b>	608
<i>K. Wang, M. Wang</i>	
<b>Fluid Dynamics and Aero-Optical Environment Around Turrets.....</b>	621
<i>S. Gordeyev, E. Jumper</i>	
<b>Designing and Testing a New Shack-Hartmann High Bandwidth 2-D Wave-Front Sensor .....</b>	634
<i>S. Abado, S. Gordeyev, E. Jumper</i>	

<b>Obtaining Velocity Distribution Using a Xenon Ion Line with Unknown Hyperfine Constants.....</b>	649
<i>W. Huang, A. Gallimore, T. Smith</i>	
<b>Measurement of Two-Photon Absorption Cross Sections in Neutral Xenon.....</b>	661
<i>C. Eichhorn, S. Fritzsche, S. Löhle</i>	
<b>Velocity Measurements in Unseeded Air Flows by Microwave Scattering from a Laser Generated Microvolume Plasma.....</b>	668
<i>A. Dogariu, S. Zaidi, O. Williams, R. Miles</i>	

**Author Index**