

47th AIAA Thermophysics Conference 2017

Held at the AIAA Aviation Forum 2017

Denver, Colorado, USA
5 - 9 June 2017

ISBN: 978-1-5108-4377-6

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

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 34922 Uwytkug'Xcmg{'Ftkxg.'Uwyg'422, Reston, VA 20191, USA.

TABLE OF CONTENTS

TP-01: REACTING FLOWS I

Master Equation Simulation of O₂-N₂ Collisions on an Ab-initio Potential Energy Surface (AIAA 2017-3163)	1
<i>Daniil Andrienko, Iain D. Boyd</i>	
Ab Initio Based Rovibrational Grouping Model for N₂(¹Σ_g⁺)-N₂(¹Σ_g⁺) Energy Transfer and Dissociation (AIAA 2017-3164)	16
<i>Robyn L. Macdonald, Richard L. Jaffe, David W. Schwenke, Alessandro Munafò, Marco Panesi</i>	
Coarse Grain Modeling and Direct Molecular Simulation of Nitrogen Dissociation (AIAA 2017-3165)	40
<i>Robyn L. Macdonald, Maninder S. Grover, Thomas E. Schwartzentruber, Marco Panesi</i>	
Quasi-classical Trajectory Studies of N₂+O Collisions: Trajectory Patterns and Long-lived Configurations (AIAA 2017-3166)	54
<i>Han Luo, Sergey Macheret, Alina Alexeenko</i>	
Quasiclassical Trajectory Analysis of N₂+O₂ and Implications for Hypersonic CFD (AIAA 2017-3167)	63
<i>Ross S. Chaudhry, Jason D. Bender, Thomas E. Schwartzentruber, Graham V. Candler</i>	

TP-02: ABLATION I

Conjugate Analysis of Rocket Nozzle Ablation (AIAA 2017-3351)	90
<i>Peter G. Cross, Iain D. Boyd</i>	
Numerical Simulation of a Non-charring Ablator in High Enthalpy Flows by Means of a Unified Flow-material Solver (AIAA 2017-3352)	112
<i>Pierre Schrooyen, Joffrey Coheur, Alessandro Turchi, Koen Hillewaert, Philippe Chatelain, Thierry Magin</i>	
Arcjet Tests and Thermal Response Analysis for Dual-Layer Woven Carbon Phenolic (AIAA 2017-3353)	127
<i>Frank S. Milos, Yih-Kanq Chen, Milad Mahzari</i>	
Verification of a Finite-Element Model for Pyrolyzing Ablative Materials (AIAA 2017-3354)	144
<i>Timothy K. Risch</i>	
Development of a Universal Solver and Its Application to Ablation Problems (AIAA 2017-3355)	179
<i>Haoyue Weng, Alexandre Martin</i>	
Development Of VISTA, An Open-source Avcoat Material Database (AIAA 2017-3356)	195
<i>Ali Omidy, Justin Cooper, Rui Fu, Haoyue Weng, Alexandre Martin</i>	
Characterization of Virgin and Charred PICA Seeded for Remote Recession Measurements (AIAA 2017-3357)	211
<i>Butler Bradley, Michael Winter, Margaret Stackpoole</i>	

TP-03: REACTING FLOWS II

The Effect of the Spin-forbidden CO (¹Σ⁺) + O (³P) → CO₂ (¹Σ_g⁺) Recombination Reaction on Afterbody Heating of Mars Entry Vehicles (AIAA 2017-3486)	223
<i>Lu T. Xu, Richard L. Jaffe, David W. Schwenke, Marco Panesi</i>	
Simulation of Oxygen Dissociation on a Six-dimensional O₄ Potential Energy Surface (AIAA 2017-3487)	245
<i>Daniil Andrienko, Iain D. Boyd</i>	
Internal Energy Relaxation and Dissociation in Molecular Oxygen Using Direct Molecular Simulation (AIAA 2017-3488)	258
<i>Maninder S. Grover, Thomas E. Schwartzentruber</i>	
State-to-State Kinetic Modeling of Select Air Species in Hypersonic Nonequilibrium Flows (AIAA 2017-3489)	275
<i>Eswar Josyula, Casimir Suchyta, Konstantinos Vogiatzis, Prakash Vedula</i>	
Coupled Vibration-Rotation Dissociation Model for Nitrogen from Direct Molecular Simulations (AIAA 2017-3490)	297
<i>Narendra Singh, Thomas E. Schwartzentruber</i>	

TP-04: ABLATION II

Reduced Reaction Mechanism for Rocket Nozzle Ablation Simulations (AIAA 2017-3682)	310
<i>Peter G. Cross, Iain D. Boyd</i>	
Development of a Unified Model for Flow-material Interaction Applied to Porous Charring Ablators (AIAA 2017-3684)	328
<i>Joffrey Coheur, Alessandro Turchi, Pierre Schrooyen, Thierry Magin</i>	
Decoupled Method for Reconstruction of Surface Conditions From Internal Temperatures On Ablative Materials With Uncertain Recession Model (AIAA 2017-3685)	341
<i>Brandon Oliver</i>	
Modeling Gasification of Carbon Fiber Preform in Oxygen Rich Environments (AIAA 2017-3686)	368
<i>Ali Omidy, Alexandre Martin, Haoyue Weng, Jose Grana-Otero</i>	
DSMC Analysis of Molecular Beam Experiments on Light-Weight Carbon Preform Ablators (AIAA 2017-3687)	378
<i>Arnaud Borner, Krishnan Swaminathan Gopalan, Kelly A. Stephani, Vanessa Murray, Savio J. Poovathingal, Timothy Minton, Francesco Panerai, Nagi N. Mansour</i>	

TP-06: NON-CONTINUUM MODELING

Investigation of a Coupling Approach of DSMC and DG Methods for Tail-driven Processes (AIAA 2017-4023)	388
<i>Tzu-Jung Pan, Kelly A. Stephani</i>	
Multi-Group Maximum Entropy Model for Translational Non-Equilibrium (AIAA 2017-4024)	398
<i>Vegnesh Jayaraman, Yen Liu, Marco Panesi</i>	
Modeling Hypersonic Reacting Flows Using DSMC with the Bias Reaction Model (AIAA 2017-4025)	411
<i>Sergey F. Gimelshein, Ingrid Wysong</i>	
An Analysis of Numerical Convergence in Discrete Velocity Gas Dynamics for Internal Flows (AIAA 2017-4026)	426
<i>Aarthi Sekaran, Philip L. Varghese, David B. Goldstein</i>	
DSMC Aerothermal Study for 3U CubeSat Probes in LEO (AIAA 2017-4027)	445
<i>Aaron Pikus, Andrew Berger, Matt Bolliger, Devon Parkos, Alina Alexeenko</i>	
Novel Use of AMR Unstructured Grids in DSMC Compressible Flow Simulations (AIAA 2017-4028)	456
<i>Saurabh Sawant, Ozgur Tumuklu, Revathi Jambunathan, Deborah A. Levin</i>	

TP-08: HYPERSONICS AND THERMAL MANAGEMENT

Effect of Transport Coefficients Modeling on Hypersonic Non-equilibrium Flow Simulations (AIAA 2017-4341)	505
<i>Xiaowen Wang</i>	
Post-Shock Temperature and CO Number Density Measurements in CO and CO₂ (AIAA 2017-4342)	517
<i>Megan E. MacDonald, Aaron M. Brandis, Brett A. Cruden</i>	
Influence of Surface Chemistry on Continuum Breakdown in High-Speed Chemically Reacting Flows (AIAA 2017-4343)	535
<i>Sharanya Subramaniam, Kelly A. Stephani</i>	
Venus Lander Electronics Payload Thermal Management Using a Multi-stage Refrigeration System (AIAA 2017-4344)	550
<i>Kevin R. Anderson, Christopher McNamara, Ariel Gatti</i>	
Prediction of Cool-Down Time of a Solid Rocket Motor by a Surrogate Model (AIAA 2017-4345)	566
<i>Ceyhan Tola, Melike Nikbay</i>	

TP-09: ADVANCED AND MULTIPHASE MODELING

Construction of Finite Rate Surface Chemistry Models From Molecular Beam Experimental Data (AIAA 2017-4347)	577
<i>Krishnan Swaminathan Gopalan, Kelly A. Stephani</i>	
Analysis of Smoke-Aerosol Formation in Pressurized Turbulent Kerosene/Air Flames Using Different Soot Models (AIAA 2017-4349)	594
<i>Masoud Darbandi, Majid Ghafourizadeh, Mohammad Hasan Saidi, G E. Schneider</i>	

Comparison of Image Preprocessing Methods for Fuel Droplet Characterization (AIAA 2017-4350)	601
<i>Cyprien Jourdain, Julien Weiss, Patrice Seers</i>	
Evaluation of an Eulerian-Lagrangian Spray Atomization (ELSA) Model for Nozzle Flow: Modeling of Coupling between Dense and Disperse Regions (AIAA 2017-4352)	616
<i>Timothy F. Leung, Clinton P. Groth, John Hu</i>	

TP-10: ARC JET/PLASMA FLOWS

Rarefaction Effects in NASA Arc Jet Testing at SCIROCCO Facility (AIAA 2017-4450)	630
<i>Davide Cinquegrana, Raffaele Votta, Eduardo Trifoni</i>	
CFD Simulations of the IHF Arc-Jet Flow: Compression-Pad/Separation Bolt Wedge Tests (AIAA 2017-4451)	641
<i>Tahir Gokcen, Kristina Skokova</i>	
Evidence of Standing Waves in Arc Jet Nozzle Flow (AIAA 2017-4452)	667
<i>David M. Driver, J. Hartman, Daniel Philippidis, Eric A. Noyes, Frank C. Hui, Imelda Terrazas-Salinas</i>	
Aerothermal Testing of Meteorite Fragments (AIAA 2017-4453)	685
<i>Stefan Loehle, Fabian Zander, Tobias A. Hermann, Martin F. Eberhart, Arne Meindl, Rainer Oefele, Jeremie Vaubailon, Pierre Vernazz, Alexis Drouard, Jerome Gattacceca</i>	

TP-13: RADIATION

Experimental and Numerical Investigation of Air Radiation in Superorbital Expanding Flow (AIAA 2017-4531)	694
<i>Han Wei, Richard G. Morgan, Timothy McIntyre, Aaron M. Brandis, Christopher O. Johnston</i>	
Backshell Radiative Heating on Human-Scale Mars Entry Vehicles (AIAA 2017-4532)	728
<i>Thomas K. West, John Theisinger, Andrew J. Brune, Christopher O. Johnston</i>	
Influence of Coupled Radiation and Ablation on Meteor Entries (AIAA 2017-4533)	750
<i>Christopher O. Johnston, Eric C. Stern</i>	
Titan Atmospheric Entry Radiative Heating (AIAA 2017-4534)	774
<i>Aaron M. Brandis, Brett A. Cruden</i>	
Measurement of Radiative Non-equilibrium for Air Shocks Between 7-9 km/s (AIAA 2017-4535)	801
<i>Brett A. Cruden, Aaron M. Brandis</i>	
3D Radiative Heat Transfer Calculations Using Monte Carlo Ray Tracing and the Hybrid Statistical Narrow Band Model for Hypersonic Vehicles (AIAA 2017-4536)	838
<i>James B. Scoggins, Andrea Lani, Philippe Riviere, Anouar Soufiani, Thierry Magin</i>	
Comparison of Wide Band, Narrow Band, and SLW Models with HITRAN and HITEMP for Predicting Radiative Heat Transfer (AIAA 2017-4537)	849
<i>Annette Fisher, Sarma Rani</i>	
Author Index	