

SP-667
January 2009

Proceedings of the 3rd International Workshop on

Radiation of High Temperature Gases in Atmospheric Entry

30 September – 3 October 2008
Heraklion, Greece

**European Space Agency
Agence spatiale européenne**

Scientific Committee

T. Abe (JAXA, Japan)
M. Capitelli (Univ. of Bari, Italy)
P. Charrier (Univ. de Bordeaux, France)
A. Chikhaoui (IUSTI, France)
M. Dudeck (CNRS, France)
M. Fertig (IRS, Germany)
D. Fletcher (UVM, USA)
C. Park (KAIST, Korea)
M-Y. Perrin (École Centrale Paris, France)
A. Smith (FGE, UK)
S. Surzhikov (IPM, Russia)
O. Chazot (VKI, Belgium)

Organising Committee

J. Ekaterinaris (FORTH and U. Patras), D. Giordano, L. Marraffa, R. Sobbia,
M. Bavdaz, A. Galvez, P. Baptista, G. Ramusat & B. Gardini (ESA), P. Omalý (CNES)

Cover image credit: CIRA

<i>Publication</i>	Proc. of 'The 3rd Int. Workshop on Radiation of High Temperature Gases in Atmospheric Entry', 30 September – 3 October 2008, Heraklion, Greece (ESA SP-667, January 2009)
<i>Edited by</i>	H. Lacoste & L. Ouwehand
<i>Published and distributed by</i>	ESA Communication Production Office ESTEC, Noordwijk, The Netherlands
<i>Price</i>	€ 30
<i>ISBN</i>	978-92-9221-231-5
<i>ISSN</i>	1609-042X
<i>Copyright</i>	© 2009 European Space Agency

CONTENTS

General Interest

Spatial Evolution of the Radiation from a Non Equilibrium CO₂ RF Plasma

A. Bultel, C. Rond, P. Boubert & B.G. Chéron

A Reinvestigation of CO₂ Radiation in the UV-Visible and IR Range

M. Lino da Silva

Modeling of a D.C. Arc Plasma Source for the Simulation of Mars Atmospheric Entry

B. Lopez, M. Dudeck & B. Izrar

Contemporary Problems of Radiation

C. Park, S.-Y. Hyun & K.-S. Chang

First Step in Theoretical Approach in Study of Mars and Titan Atmospheres with an Inductively Coupled Plasma Torch

P. André, S. Clain, M. Dudeck et al.

Mars Express Onboard Tracking of the PHOENIX Entry Plasma Plume: Simulation and Mission Outcome

M. Lino da Silva, R. Sobbia & O. Witasse

Mission Support

The Tandem Mission Proposal – A First Estimation of the Foreseeable Radiative Heat Fluxes the Montgolfière Probe will Encounter During its Entry in Titan Atmosphere

A. Lemal, L. Marraffa, L. Ferracina et al.

Numerical Investigation

Numerical Study of Convective Heating of Space Vehicle of two Different Forms

V. Kuzenov, A. Petrusev, A. Zheleznykova & S. Surzhikov

Flow Field Around Fire II Space Vehicle under Angle of Attack

A. Zheleznykova & S. Surzhikov

3D CFD Model of Aerothermodynamics of Descent Space Vehicles

P. Omaly & S. Surzhikov

Predictions of Radiative and Convective Fluxes at Stagnation Point for an Earth High-Speed Re-Entry

F. Mazoué & P. Reynier

Test Case Presentation

TC4-2-Level 1: Titan Atmosphere Plasma Radiation Measurement
M. Playez & D. G. Fletcher

Shock Layer Radiation Measurements and Analysis for Mars Entry
D. Bose, J.H. Grinstead, D.W. Bogdanoff & M.J. Wrigh

TC2

Radiation Behind a Strong Shock Wave in Martian-Like Mixtures. Description of Test Case TC2-M2: CN and C₂ Radiation Behind a Shock Wave in CO/N₂, CO₂/N₂ Mixtures and in Pure CO₂. Rebuilding of TC2-M1 and TC2-M2
P. Boubert & C. Rond

Calculations of Non-Equilibrium Radiative Signature of CO₂-N₂ Shock Tube Experiments: Contribution to TC2 Test Case
A. Munafò, M. Panesi, Y. Babou & O. Chazot

Numerical Simulations and Analysis of the 8.5 km/s CO₂-N₂ East Shock Tube Condition
D.F. Potter, R.J. Gollan, P.A. Jacobs & P. Leyland

TC2: Electronic Kinetics and Non-Equilibrium Radiation of CO₂-N₂ Shock Waves
S. Surzhikov

Radiation of High Temperature Gases: Rebuilding Test Case TC2
C. Brysbaert, L. Marraffa, R. Sobbia & L. Ferricina

Rebuilding the Test Case TC2-T2: Definition of Shock Tunnel Test Cases for Gas Radiation Prediction in Titan-Like Atmosphere – IUSTI Experiments
A. Lemal, L. Marraffa, R. Sobbia & L. Ferricina

TC3

Prediction of Flow Field Around Model of MSRO by NERAT-2D and NERAT-3D Codes
P. Omaly & S. Surzhikov

Two-Dimensional Radiation Heat Transfer to Martian Spherical Space Vehicle
D. Andrienko & S. Surzhikov

The Forth Order Accuracy Method for Energy Conservation Equation in NERAT-2D Code
A.S. Dikalyuk & S.T. Surzhikov

Contribution to TC3: Computations of the Flowfield and Heat Transfers to the Wall of the Orbiter Front Shield
N. Bédon, M.-C. Druguet & P. Boubert

TC6

Radiation-Flowfield Coupled Solutions for the FIRE-II Flight Experiment

J. A. Merrifield & M. Fertig

Radiation Modelling for Air Plasma in NonEquilibrium Conditions: Application to Earth Atmospheric Re-Entry

J.-M. Lamet, Ph. Rivière, L. Tessé et al.

Kinetics

Radiation Transport and Level Kinetics in Atomic Hydrogen Shocks

G. D'Ammando, L. D. Pietanza, G. Colonna et al.

A High-Order Scheme for Collisional-Radiative and Non-Equilibrium Plasma

M. Kapper & J.-L. Cambier

Molecular Dynamics Simulation of Dissociation and Relaxation Rates of Diatomic Molecules

D. V. Kotov & S. T. Surzhikov

Simulation of High Enthalpy Flows with Non Equilibrium Effects (Earth, Mars and Titan Type Conditions)

D. LeQuang, M. Lino da Silva, F. Passarinho & M. Dudeck

Future Test Case

VKI Plasmatron Performances Investigations: I. Air Plasma Jet Time Dependant Behaviour

I. Benito, M. Aleo & Y. Babou

VKI Plasmatron Performances Investigations: II. Air Plasma Jet Thermodynamic State

Y. Babou

Definition of a New Level One Test Case Measurements of Equilibrium Radiation from an Inductively Coupled Plasma in the Near-UV to Near-IR Spectral Region for a Titan-Type N₂-CH₄ Mixture.

Preliminary Results

D. Vacher, P. André, M. Lino da Silva et al.

Facility

The Generation and Measurements of High Temperature Radiating Flows in a High Enthalpy Pulsed Facility

T. J. McIntyre, T. N. Eichmann, M. Mallon et al.

Overview of Radiation Intensity Measurements on the X2 Facility at the University of Queensland

A. Brandis, T. McIntyre, R. Morgan & P. Jacobs

Overview on Studies of Martian Like CO₂-N₂ Mixture by Inductively Coupled Plasma Torch

D. Vacher, P. André & M. Dudeck

Hypersonic Free Stream Characterization in LBK by Laser Induced Fluorescence and Diode Laser Absorption Spectroscopy

U. Koch, J. Riehmer B. Esser & A. Gülhan

List of Participants

Additional Material

All additional material (Text, PowerPoint, movies & jpegs) can be found on the CD-ROM under the folder ***additional***

/data (DATA)

/syntheses (SYNTHESES)

/presentations (WORKSHOP PRESENTATIONS)

/photos (PHOTOS)