

20TH EUREGIONAL WELTPP

Workshop on the Exploration of Low Temperature Plasma Physics



November 30 and December 1, 2017

"Rolduc"

Kerkrade, the Netherlands

Jointly sponsored and organized by

**RUHR
UNIVERSITÄT
BOCHUM**

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Technische Universiteit
Eindhoven
University of Technology

RESEARCH DEPARTMENT
Plasmas with Complex Interactions

UNIVERSITY *of York*

 **SFB-TR 87**

 **DIFFER**
Dutch Institute for
Fundamental Energy Research

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Optics**

20TH EUREGIONAL WELTPP

Workshop on the Exploration of Low Temperature Plasma Physics

Welcome to the 20th *Workshop on the Exploration of Low Temperature Plasma Physics* (WELTPP-20). This workshop is intended for active scientists working in the field of low temperature plasma physics.

The aim of this workshop is to create a forum for young low temperature plasma scientists, that is graduate students and postdoctoral researchers, to meet, learn from each other, exchange knowledge, present results and establish new contacts. The emphasis is on the presentation of the work of the people new in this field.

The workshop is sponsored and organized by the Research Department "Plasmas with complex interactions" of the Ruhr-Universität Bochum, SFB-TR 87, and the Eindhoven University of Technology, more precisely by the groups Plasma and Materials Processing (PMP) and Elementary Processes in Gas Discharges (EPG) in close collaboration with the Dutch Institute for Fundamental Energy Research (DIFFER) and the York Plasma Institute. This year WELTPP-20 is also kindly supported by Ocean Optics B.V.

We wish you a fruitful and pleasant conference.

Organizing committee:

Jan van Dijk (Eindhoven University of Technology)
Richard Engeln (Eindhoven University of Technology)
Jeanne Loonen (Eindhoven University of Technology)
Frederik Schmidt (Ruhr-Universität Bochum)
Erik Wagenaars (York Plasma Institute)
Stefan Welzel (FOM Institute DIFFER & Eindhoven University of Technology)





Oral presentations

Programme WELTPP at Rolduc, November 30 & December 1, 2017

Thursday, November 30th

10.30 Registration (coffee/tea in the Foyer)
10.50 Opening

Session 1 Plasmadiagnostics (Conference room 4)
11.00-11.20 O1 **Fast imaging of nanosecond-pulsed plasmas generated in liquids**
K. Grosse (Ruhr-University Bochum)
11.20-11.40 O2 **Measurement of Ar resonance and metastable level number densities in argon containing plasmas**
M. Fiebrandt (Ruhr-University Bochum)
11.40-12.00 O3 **Electron density at the sheath edge of a HiPIMS plasma**
J. Held (Ruhr-University Bochum)
12.00-12.20 O4 **Correlation of spatially resolved in-vacuum XPS characterization and optical diagnostics for magnetron targets in HiPIMS plasma**
S. Monjé (Ruhr-University Bochum)
12.20-12.40 O5 **Laser ablation of metal and metal-oxide targets, and applications towards plasma enhanced-pulsed laser deposition**
D. Meehan (York Plasma Institute)

12.45 Lunch in the “Grote Eetzaal”

Session 2 Plasma Modelling (Conference room 4)
14.00-14.20 O6 **Kinetic modelling of the planar multipole resonance probe using functional analytic methods**
M. Friedrichs (Leuphana University Lüneburg)
14.20-14.40 O7 **Power transfer and impedance matching in capacitive discharges**
F. Schmidt (Ruhr-University Bochum)
14.40-15.00 O8 **Analytic model of the plasma sheath**
L. Kroll (Ruhr-University Bochum)
15.00-15.20 O9 **Impedance modeling for DF-plasmas where one of the frequencies is well below the ion plasma frequency**
J. Kuhfeld (Ruhr-University Bochum)

15.30 Coffee/Tea in the Foyer

15:30-16:30 **Rolduc historical tour**
(Registration through registration desk (max. 30 persons))

16:30-18:15 **Poster session** (Conference room 2)
Poster numbers P1 – P14 can be posted from 12:00 hrs.

Session 3 CO₂ containing plasmas (Conference room 4)
18:30-18:50 O10 **Vibrational excitation kinetics of CO₂ in a pulsed glow discharge**
B. Klarenaar (Eindhoven University of Technology)
18:50-19:10 O11 **Vibrational kinetics of non-equilibrium CO₂ plasma discharge and post-discharge: comparison with experiment**
M. Grofulović (Universidade de Lisboa)
19:10-19:30 O12 **Dimension reduction of global models using principal component analysis**
S. Bardoel (Eindhoven University of Technology)

19.45 Dinner in “De Verloren Zoon” & “KANA”

From 21.00 the bar in “De Verloren Zoon” will be open.



Friday, December 1st

08.00 Breakfast in the “Grote Eetzaal”

Please return your room key to the reception before attending Session 4!

Session 4 Ions in plasmas (Conference room 4)
09.00-09.20 O13 Investigation of ion dynamics in capacitively coupled Argon-Xenon discharges
M. Klich (Ruhr-University Bochum)
09.20-09.40 O14 Study of ion fluxes in extreme ultraviolet radiation induced hydrogen plasma
T. van de Ven (Eindhoven University of Technology)
09.40-10.00 O15 Surface production of negative ions on nitrogen doped diamond samples
J. Ellis (York Plasma Institute)
10.00-10.20 O16 IVDF and plasma parameters of CX dominated plasmas
C. Lütke Stetzkamp (Ruhr-University Bochum)

10.30 Coffee/Tea in the Foyer

11.00-12.30 Poster session (Conference room 2)
All poster numbers greater than P14 can be posted

12.30 Lunch in the “Grote Eetzaal”

Session 5 Application of high-frequency fields (Conference room 4)
14.00-14.20 O17 Improving uniformity of atmospheric-pressure dielectric barrier discharges using dual frequency excitation
Y. Liu (DIFFER)
14.20-14.40 O18 Inactivation of *Bacillus subtilis* spores by low pressure plasma emitted UV-radiation
B. Hillebrand (Ruhr-University Bochum)
14.40-15.00 O19 Spatio-temporal plasma heating mechanisms in a radio-frequency electrothermal microthruster
S. Doyle (York Plasma Institute)
15.00-15.20 O20 Stochastic electron heating in a periodically structured electric field
P. Ahr (Ruhr-University Bochum)

15.25 Closure of the workshop





Poster presentations

List of Posters

- P1: Applying tailored voltage waveforms for control of the electron dynamics in atmospheric pressure plasmas**
L. Alelyani¹, A. Gibson², J. Bredin², S. Doyle², J. Dedrick², T. Gans², D. O'Connell²
York Plasma Institute, Department of Physics, University of York, York YO10 5DD, United Kingdom
- P2: Ion energy distributions in plasma-assisted atomic layer deposition**
K. Arts*, J. Buiters*, T. Faraz, S. Karwal, E. Kessels, H. Knoops
Department of Applied Physics, Eindhoven University of Technology, 5600 MB Eindhoven, The Netherlands
- P3: Theoretical and experimental analysis of microplasma created by a microstrip split-ring resonator**
S. Böddeker, P. Hermanns and P. Awakowicz
Institute of Electrical Engineering and Plasma Technology (AEPT), Ruhr University Bochum, Germany
- P4: Spatially resolved temperature measurements using Two-photon Absorption Laser-Induced Fluorescence**
M.A. Damen¹, A.W. van de Steeg¹, P.D. Machura, R. Engeln¹
¹*Department of Applied Physics, Eindhoven University of Technology, 5600 MB Eindhoven, The Netherlands*
- P5: Planeterrella**
N.J.J. van Dijk, S. Nijdam
Department of Applied Physics, Eindhoven University of Technology, 5600 MB Eindhoven, The Netherlands
- P6: Analysis of a lumped circuit model for radio frequency magnetron sputtering**
Dennis Engel, Laura Kroll, Dennis Krüger, Ralf Peter Brinkmann
Institute of Electrical Engineering and Plasma Technology, Ruhr University Bochum, Germany
- P7: Spectral kinetic simulation of ideal multipole resonance probe**
Junbo Gong¹, Sebastian Wilczek¹, Jens Oberrath², Denis Eremin¹, Michael Friedrichs², and Ralf Peter Brinkmann¹
¹*Institute of Theoretical Electrical Engineering, Ruhr-University Bochum, Germany*
²*Institute of Product and Process Innovation, Leuphana University Lüneburg, Germany*

- P8: **Characterization of a spark discharge of spark plugs for modern combustion engines using optical methods**
 S. Gröger, M. Hamme and P. Awakowicz
*Institute of Electrical Engineering and Plasma Technology,
 Ruhr University Bochum, Germany*
- P9: **Determination of plasma parameters in a low pressure, microwave driven microplasma by means of optical emission spectroscopy**
 P. Hermanns, S. Böddeker and P. Awakowicz
*Institute of Electrical Engineering and Plasma Technology (AEPT),
 Ruhr University Bochum, Germany*
- P10: **Calculating vibrational-vibrational rates of CO₂**
J.F.J. Janssen^{1,2}, J.L.G. Suijker¹, P.M.J. Koelman¹, S. Tadayon Mousavi¹, J. van Dijk¹
¹ *Eindhoven University of Technology, Department of Applied Physics, P.O. Box 513, 5600 MB Eindhoven, The Netherlands*
² *PlasmaMatters, Department of Applied Physics, P.O. Box 513, 5600 MB Eindhoven, The Netherlands*
- P11: **“Bystander effect” Or how the plasma induce the cancer cells to diffuse the death cell signals**
 Shahriar Mirpour^{1,2}, Neda Jalali Farahani³, Shiva Irani⁴, Maryam Abbasi⁴, Neda.Soleimani⁵
¹ *Elementary Processes in Gas Discharges, Eindhoven University of Technology, NL*
² *Laser and Plasma Institute, Shahid Beheshti University, Tehran, Iran*
³ *Plasma physics research center, Science and Research Branch, Islamic Azad University, Tehran, Iran*
⁴ *Department of biology, Science and Research Branch, Islamic Azad University, Tehran, Iran*
⁵ *Department of Medical Science, Tarbiat Modarres University, Tehran, Iran*
- P12: **SAINT: Science and Innovation with Thunderstorm**
 Shahriar Mirpour, Sander Nijdam
*Department of Physics, Eindhoven University of Technology,
 Eindhoven, The Netherlands*

- P13: Spatially-resolved characterisation of a dielectric barrier discharge in controlled atmosphere**
 Friederike Kogelheide², Björn Offerhaus², Nikita Bibinov²,
 Jan-Wilm Lackmann³, Peter Awakowicz², Katharina Stapelmann¹
¹*Institute for Electrical Engineering and Plasma Technology (AEPT),
 Ruhr University Bochum, Germany*
²*Department of Nuclear Engineering, North Carolina State University, United States*
³*Leipniz Institute for Plasma Science and Technology, Greifswald, Germany*
- P14: Streamer Discharge Splitting Characteristics in Liquid Dielectric under Impulse Voltage and AC Voltage**
 Yuan Li^{1,2}, Jia-Ye Wen¹, Guan-Jun Zhang¹
¹*State Key Lab of Electrical Insulation & Power Equipment, School of Electrical Engineering, Xi'an Jiaotong University, 28 Xianning West Road Xi'an, Shaanxi 710049 China*
²*Department of Applied Physics, Eindhoven University of Technology, PO Box 513, 5600 MB Eindhoven, The Netherlands*
- P15: Uncertainty analysis for Global Models with a large chemistry**
 Peter Koelman¹, Danka Yordanova², Samaneh Tadayon Mousavi¹, Jesper Janssen^{1,3}, Wouter Graef³, Diana Mihailova³, Jan van Dijk¹,
¹*Eindhoven University of Technology*
²*Institute of Solid State Physics, Bulgarian Academy of Sciences*
³*Plasma Matters B.V.*
- P16: PLASIMO modelling of hollow cathode discharges**
 D. Yordanova¹, D. Mihailova², J. van Dijk³
¹*Institute of Solid State Physics, Bulgarian Academy of Sciences, Sofia, Bulgaria*
²*Plasma Matters B.V., Eindhoven, The Netherlands*
³*Eindhoven University of Technology, Eindhoven, The Netherlands*
- P17: Dust particles suspended in an argon Rf-discharge sheath, while using gravity as a variable**
 Patrick Meijaard, Tim Donders, Job Beckers
Eindhoven University of Technology, Eindhoven, The Netherlands
- P18: Influence of ion energy and atomic oxygen flux on the deposition of silicon oxide barrier films**
 F. Mitschker¹, Ch. Hoppe², T. de los Arcos², G. Grundmeier² and P. Awakowicz¹
¹*Electrical Engineering and Plasma Technology, Ruhr-University Bochum, Germany*
²*Chemical Engineering and Macromolecular Chemistry, University of Paderborn, Germany*
- P19: Validation of He-H₂O Global Model with experiment**

S. Tadayon Mousavi¹, A.J. Wolf², P.M.J. Koelman¹, J.F.J. Janssen^{1,3},
W.A.A.D. Graef³, D.B. Mihailova³, W.A. Bongers², and J. van Dijk¹
¹*Eindhoven University of Technology, Eindhoven, 5600MB, The Netherlands*
²*Dutch Institute for Fundamental Energy Research (DIFFER), 5600 HH
Eindhoven, The Netherlands*
³*Plasma Matters B.V., Den Dolech 2, 5612 AZ Eindhoven, The Netherlands*

P20: Spatially resolved emission and absorption measurements in a twin surface dielectric barrier discharge ignited in defined gas mixtures

B. Offerhaus¹, F. Kogelheide², P. Krajinski¹, R. Smith¹, N. Bibinov¹, K. Stapelmann², P. Awakowicz¹

¹*Institute of Electrical Engineering & Plasma Technology (AEPT), Ruhr University Bochum*

²*Department of Nuclear Engineering, North Carolina State University*

P21: Optical spectroscopic investigations of a He plasma jet in a controlled atmosphere

M.C. de Peuter¹, A. Sobota¹ and W.F.L.M. Hoeben²

Eindhoven University of Technology, 5600 MB, Eindhoven, The Netherlands.

¹*Department of Applied Physics*

²*Department of Electrical Engineering*

P22: Laser induced plasma shock wave simulation for laser shock peening

Vasily Pozdnyakov, Jens Oberrath

Institute of Product and Process Innovation, Leuphana University Lüneburg, Germany

P23: Comparative investigation of plasma deposited gas barrier coatings for polymers using hexamethyldisiloxane and hexamethyldisilazane

L. Schücke¹, F. Mitschker¹, Ch. Hoppe², T. de los Arcos², G. Grundmeier² and P. Awakowicz¹

¹*Electrical Engineering and Plasma Technology, Ruhr-University Bochum, Germany*

²*Chemical Engineering and Macromolecular Chemistry, University of Paderborn, Germany*

P24: PLASIMO's 5T-amplifier model for CO₂-laser amplification

S.C. Selvi¹, D. Mihailova², J. van Dijk¹, W.A.A.D. Graef², and P. Muys³

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³*ASML, Veldhoven, 5504DR, The Netherlands*

P25: Electric field four-wave mixing with focused laser beams: validity of the plane-wave approximation

M. van der Schans¹, S. Nijdam¹ and W.L. IJzerman^{2,3}

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The Netherlands*

² *Eindhoven University of Technology, Department of Mathematics and
Computer Science, The Netherlands*

³ *Philips Lighting, The Netherlands*

P26: Measuring electric field inside microwave cavities for plasma diagnostics

J.P.W.F. van Dongen, B. Platier, F.M.J.H. van de Wetering, J. Beckers
*Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven,
The Netherlands*

P27: (De)charging of particles advancing through spatial plasma

B. van Minderhout¹, T. Peijnenburg², P. Blom² and J. Beckers¹

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