

# 21<sup>ST</sup> EUREGIONAL WELTPP

*Workshop on the Exploration of Low Temperature Plasma Physics*



**November 29 and 30, 2018**

**"Rolduc"  
Kerkrade, the Netherlands**

Jointly sponsored and organized by

RUHR  
UNIVERSITÄT  
BOCHUM

**RUB**

**TU/e** EINDHOVEN  
UNIVERSITY OF  
TECHNOLOGY

RESEARCH DEPARTMENT  
Plasmas with Complex Interactions

 **DIFFER**  
Dutch Institute for  
Fundamental Energy Research

 **SFB-TR 87**

  
**LEUPHANA**  
UNIVERSITÄT LÜNEBURG

UNIVERSITY *of York*

**b-tu** Brandenburg  
University of Technology  
Cottbus - Senftenberg

 **Ocean  
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# 21<sup>ST</sup> EUREGIONAL WELTPP

## *Workshop on the Exploration of Low Temperature Plasma Physics*

Welcome to the 21<sup>st</sup> *Workshop on the Exploration of Low Temperature Plasma Physics* (WELTPP-21). 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 jointly sponsored and organised by Eindhoven University of Technology (TU/e) and the Research Department *Plasmas with Complex Interactions* of the Ruhr-Universität Bochum (RUB) in the framework of SFB-TR 87.

**WELTPP** was born in close collaboration between the research groups in Eindhoven and Bochum, that are Plasma and Materials Processing (*PMP, TU/e*), Elementary Processes in Gas Discharges (*EPG, TU/e*), The Institute of Theoretical Electrical Engineering (*TET, RUB*) and The Institute for Electrical Engineering and Plasma Technology (*AEPT, RUB*). Some years ago York Plasma Institute (*YPI*) and the Dutch Institute for Fundamental Research (*DIFFER*) joined the organisers. Since former members of the organising committee have found their own new challenges we are happy to welcome also Leuphana University of Lüneburg and Brandenburg University of Technology Cottbus-Senftenberg among the co-organisers.

Also this year **WELTPP-21** is kindly supported by Ocean Optics.

### **Local Organisers**

Jeanne Loonen (Eindhoven University of Technology)  
Stefan Welzel (DIFFER)

### **Advisory committee**

Stefan Welzel (DIFFER)  
Richard Engeln (Eindhoven University of Technology)  
Jan van Dijk (Eindhoven University of Technology)  
Frederik Schmidt (Ruhr-Universität Bochum)  
Erik Wagenaars (York Plasma Institute at University of York)  
Jens Oberrath (Leuphana University of Lüneburg)  
Jan Trieschmann (Brandenburg University of Technology Cottbus-Senftenberg)







Oral presentations

# Programme WELTPP at Rolduc, November 29 and 30, 2018

*Thursday, November 29<sup>th</sup>*

10:35 Registration (coffee/tea in the Foyer)  
10:55 Opening

**Session 1 Plasmas, Charges and Surfaces** (Conference room 4)  
11:05-11:25 O1 **The possible influence of charge and charged particles during ALD and plasma ALD**  
D.C. Schram (Eindhoven University of Technology)  
11:25-12:25 O2 **INVITED**  
**Surface charge in plasma catalysis: origin of observed synergies?**  
E. Neyts (University of Antwerp)

12:30 Lunch in the “Grote Eetzaal”

**Session 2 Plasma Modelling** (Conference room 4)  
14:00-14:20 O3 **Synergy effects in low pressure capacitively coupled Argon-Xenon discharges**  
M. Klich (Ruhr-University Bochum)  
14:20-14:40 O4 **Machine learning plasma-surface interface for coupling sputtering and gas-phase transport simulations**  
F. Krüger (Ruhr-University Bochum)  
14:40-15:00 O5 **Analysis of the planar multipole resonance probe using a kinetic model**  
M. Friedrichs (Leuphana University Lüneburg)  
15:00-15:20 O6 **Laser shock peening global modeling**  
V. Pozdnyakov (Leuphana University Lüneburg)

15.30 Coffee/Tea in the Foyer

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

16:30-18:00 **Poster session I** (Conference room 2)  
Poster numbers P1 – P15 can be posted from 12:00 hrs.

**Session 3 High Frequency Discharges** (Conference room 4)  
18:10-18:30 O7 **Absolute atomic chlorine density measurements in the effluent of a radio-frequency atmospheric pressure plasma**  
J G Boothroyd (York Plasma Institute)  
18:30-18:50 O8 **Ellipsometric analysis of nanostructures in thin SiO<sub>x</sub>-films**  
R. Buschhaus (Ruhr-University Bochum)  
18:50-19:10 O9 **Absolute density measurements of atomic hydrogen in an ICP**  
J. Ellis (University of York)  
19:10-19:30 O10 **Phase-resolved monitoring and extraction of nanoparticle during particle growth cycles in an acetylene plasma**  
Z. Marvi (Eindhoven University of Technology)

19:45 Dinner in “De Verloren Zoon” & “KANA 1”

From 21:00 the bar in “De Verloren Zoon” will be open.



**Friday, November 30<sup>th</sup>**

**08:00 Breakfast in the “Grote Eetzaal”**

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

- Session 4 CO<sub>2</sub> Containing Plasmas (Conference room 4)**
- 09:00-09:20 O11 Dissociation of CO<sub>2</sub> in a non-equilibrium atmospheric pressure helium plasma jet in the presence of a catalyst**  
T. Urbanietz (Ruhr-University Bochum)
- 09:20-09:40 O12 Laser-induced fluorescence in nanosecond discharges for CO<sub>2</sub> conversion**  
L.M. Martini (Eindhoven University of Technology)
- 09:40-10:00 O13 Monte Carlo flux simulation of electrons for plasma modelling**  
L. Vialetto (DIFFER)
- 10:00-10:20 O14 On the reservoir model for CO<sub>2</sub>-laser amplification**  
S.C. Selvi (Eindhoven University of Technology)
- 10:20-10:40 O15 Optimizing the vibrational non-equilibrium of CO<sub>2</sub> microwave plasma by fast pulsing**  
A. van de Steeg (DIFFER)
- 10:45 Coffee/Tea in the Foyer**
- 10:45-12:15 Poster session II (Conference room 2)**  
All poster numbers greater than P15 can be posted
- 12:30 Lunch in the “Grote Eetzaal”**
- Session 5 Plasma Diagnostics (Conference room 4)**
- 14:00-14:20 O16 Temporal evolution of the electron density of a nanosecond discharge in distilled water**  
K. Grosse (Ruhr-University Bochum)
- 14:20-14:40 O17 Velocity distribution of titanium neutrals in the target region of high power impulse magnetron sputtering discharges**  
J. Held (Ruhr-University Bochum)
- 14:40-15:00 O18 Connection between target poisoning and current waveforms in reactive high power impulse magnetron sputtering of chromium**  
S. Thiemann-Monje (Ruhr-University Bochum)
- 15:00-15:20 O19 Measurements of the electric field, electron properties and other plasma parameters: the influence of targets**  
M. Hofmans (Eindhoven University of Technology)
- 15:20 Closure of the workshop**





Poster presentations





## List of Posters

**Thursday, 29th November 2018**

- P1: **Image processing based control of global microdischarge behaviour during unipolar pulsed Plasma Electrolytic Oxidation (PEO)**  
S. Böddeker, P. Hermanns, V. Bracht and P. Awakowicz
- P2: **Analysis of current voltage behavior for radio frequency magnetron sputtering**  
D. Engel, L. Kroll and R.P. Brinkmann
- P3: **Analysis of HVDC relays in short circuit situation**  
C.M. Ewuntomah and J. Oberrath
- P4: **Determination of Atomic Oxygen State Densities in an Ar:O<sub>2</sub> Plasma Using Absolute Line Intensities**  
M. Fiebrandt, N. Bibinov and P. Awakowicz
- P5: **Discretization scheme for systems of diffusion-reaction conservation laws**  
R.A.M. van Gestel, J.van Dijk and J.H.M. ten Thije Boonkkamp
- P6: **Chemical reduction: The Recipe**  
J.G.M. Gulpen, J. van Dijk and D..B. Mihailova
- P7: **Determination of electron densities by stark broadening of hydrogen lines in an electrosurgical argon plasma**  
B. Hillebrand, E. Iglesias and P. Awakowicz
- P8: **Calibration method for electric field values obtained using Stark spectroscopy**  
S. Kempers, M. Hofmans and A. Sobota
- P9: **Analytical solutions of the two-term Boltzmann equation**  
P. Koelman and J. van Dijk
- P10: **Using plasma-levitated micro-particles to reveal the equipotential surface in the plasma sheath**  
A.J.T. Lamberts, P. Meijaard, G.M.W. Kroesen and J. Beckers
- P11: **Electric field measurements on plasma bullets in nitrogen with nanosecond electric field induced second-harmonic generation**  
A. Limburg, M. van der Schans and S. Nijdam

- P12: **A Detailed Model for Dielectric Barrier Discharge in Argon**  
B. Mahdavi pour, S. Dahle, J. Oberrath
- P13: **Kinetic Modeling and Simulation of the Planar Multipole Resonance Probe**  
C. Wang, M. Friedrichs, J. Oberrath and R.P. Brinkmann
- P14: **Two-Temperature Global Model for Complex Plasma Chemistry**  
S. Tadayon Mousavi, W.A.A.D. Graef, P.M.J. Koelman, J.F.J. Janssen, and J. van Dijk
- P15: **Clustered micro-particles in remote plasma afterglow**  
B. van Minderhout, A. Post, T. Peijnenburg, P. Blom, J.M. Vogels, G.M.W. Kroesen and J. Beckers

## Friday, 30th November 2018

- P16: **Emergence of multiple streamers during short and long pulsed discharges**  
S. Mirpour and S. Nijdam
- P17: **The development of a plasma-based lice comb**  
L.C. van Mouche and A. Sobota
- P18: **Experimental proof of the Magnetic Asymmetry Effect in a capacitively coupled rf plasma**  
M. Oberberg, P. Awakowicz and J. Schulze
- P19: **Application of a twin-surface dielectric barrier discharge for the plasma-assisted removal of oxygen traces from hydrogen-containing gases**  
K. Ollegott, P. Wirth, N. Peters, P. Awakowicz, M. Muhler
- P20: **Characterization of a twin-surface dielectric barrier discharge for the plasma-assisted removal of oxygen traces from hydrogen-containing gases**  
P. Wirth, K. Ollegott, M. Fiebrandt, M. Muhler and P. Awakowicz
- P21: **Plasma Catalysis as Vibrational Activation of Surface Interactions**  
Q. Ong, D.C.M van den Bekerom, M.A. Gleeson, C.J. Weststrate and G.J. van Rooij
- P22: **Spatial and temporal behavior of an atmospheric He plasma jet**  
O.J.A.P. van Rooij, M. Hofmans and A. Sobota
- P23: **CO<sub>2</sub> decomposition in microwave plasmas; a computational investigation**  
C.E.M. Schoutrop, J. van Dijk, W.A.A.D. Graef
- P24: **Measuring surface charge on nanoparticle using FT-IR spectroscopy**  
T.J.A. Staps, R. Brookhuis, G.W.M. Kroesen and J. Beckers
- P25: **Investigating the argon RF-plasma sheath using Multi-mode Microwave Cavity Resonance Spectroscopy**  
P. Meijaard, B. Platier and J. Beckers

- P26: **The injection of nanoparticles into a low pressure microwave plasma**  
S.F.W. Telkamp, T.J.A. Staps and J. Beckers
- P27: **Self-consistent diffusion approach to CO<sub>2</sub> vibrational kinetics**  
P. Viegas, M. C. M. van de Sanden, S. Longo and P. Diomede
- P28: **Characterizing the temperature profile of a sub-atmospheric CO<sub>2</sub> microwave plasma by Thomson Scattering**  
T. van Vught, S. Dijcks and S. Nijdam
- P29: **Conversion of CO<sub>2</sub> into CO in CO<sub>2</sub>/Ar glow discharges**  
A.Silva, A.S. Morillo-Candas, A. Tejero-del-Caz, V. Guerra, O. Guaitella

