P 11: Atmospheric Pressure Plasmas III

Zeit: Dienstag 14:00–15:30 Raum: HS 21

Hauptvortrag P 11.1 Di 14:00 HS 21

Electrical and optical characterisation of pulsed, single-filament dielectric barrier discharges on a water surface — •Hans Höft, Manfred Kettlitz, and Ronny Brandenburg — Leibniz-Institut für Plasmaforschung und Technologie e.V. (INP Greifswald), Felix-Hausdorff-Straße 2, 17489 Greifswald

A dielectric barrier discharge (DBD) on purified water was investigated by means of synchronised, fast electrical and optical diagnostics. For that purpose, a single, alumina-covered electrode with 2 mm radius was placed 1.5 mm above a standing liquid surface (purified water) and a grounded tungsten electrode underwater. The gas gap was constantly flushed with 0.1 vol% O_2 in N_2 at atmospheric pressure. The applied high-voltage (HV) pulse with ≈ 15 ns rise time was supplied by a fast Behlke switch using symmetrical, unipolar positive and negative amplitudes of 15 kV at 2 kHz repetition frequency. The diagnostics consisted of fast voltage and current probes and a gated iCCD camera to record the discharge structure occurring during the rising and falling slopes of the HV pulse. The current was measured at the grounded and the HV side. A single discharge event occurs at rising and falling slopes of the HV pulse. Due to character of DBDs the discharge at the slope, which turns to zero, is induced by surface charges on the dielectric surfaces. Depending on the polarity of the HV pulse, the surface charges are either positive (negative HV pulse) or negative (positive HV pulse). Consequently, distinct discharge morphologies were observed and correlated to the discharge current and the transferred charge per discharge event.

P 11.2 Di 14:30 HS 21

Influence of Atmospheric Compounds on Dielectric Barrier Discharge Ionisation for Mass Spectrometry — •Pascal Vogel[1], Ulrich Marggraf[1], Sebastian Brandt[1], Juan F. Garcìa-Reyes[2], Constantinos Lazarou[3], and Joachim Franzke[1] — [1]ISAS, 44139 Dortmund, Germany — [2]Analytical Chemistry Research Group, University of Jaén, Campus Las Lagunillas, 23071 Jaén, Spain — [3]Department of Electrical and Computer Engineering, University of Cyprus, Nicosia, 1678, Cyprus

In the field of analytical chemistry, atmospheric pressure plasmas have gained significant interest within the scientific community, because of their advantages according to supplementary equipment: No vacuum system is needed and measurements can be performed under ambient air. This reduces significantly the costs of analytical applications. Different kinds of plasmas have been developed within this field, such as DART, LTP, ACapI, DBDI. There have been different approaches to improve the analytical performance of those discharges, most of them by changing the plasma gas using different kind of dopants such as hydrogen, oxygen or propane. Within these studies, the interaction of the plasma with the surrounding atmosphere is rarely investigated. We will present a newly designed setup to create a controlled atmosphere that directly connects a dielectric barrier discharge to a mass spectrometer. The influence of different gases in the controlled atmosphere on the ionization efficiency and chemistry in the plasma jet will be demonstrated, without changing the plasma gas itself. Analytical benefits will be evaluated.

P 11.3 Di 14:45 HS 21

Detection and quantification of arsenic in a dielectric barrier discharge with spatial and temporal resolution — •Sebastian Burhenn[1], Jan Kratzer[2], Antje Michels[1], and Joachim Franzke[1] — [1]Leibniz Institut für Analytische Wissenschaften - ISAS - e.V., Bunsen-Kirchhoff-Str. 11, 44139 Dortmund, Germany — [2]Czech Academy of Sciences, Institute of Analytical Chemistry, Veveří 97, CZ-602 00 Brno, Czech Republic

Due to their versatility, plasmas enjoy high popularity in the field of analytical chemistry. In particular, for the detection and quantification of elements, several different plasma based approaches such as inductively coupled plasma mass spectrometry (ICP-MS) became standard. Since the operation of the ICP is related to high costs, dielectric barrier discharges (DBDs) have proven to be a simple and cost effective alternative, achieving excellent detection limits. However, the mechanisms for the atomization and excitation of the analyte in the plasma are not yet fully understood. In this work the emission signal of the model analyte arsenic, which is introduced into a capillary DBD via hydride generation is tracked with spatial and temporal resolved optical emission spectrometry (OES). The plasma inside the capillary DBD is mapped through a monochromator to the CCD of an iCCD-camera serving as a detector with a temporal resolution of 5 ns. It was shown that the emission of arsenic atoms at the 234 nm line is delayed to the emission of the background signal. This enables to temporally separate the analyte signal from the background, which enhances the signal to noise ratio and results in a low detection limit of 93 ppt.

P 11.4 Di 15:00 HS 21

Cold atmospheric plasma analysis for inactivation of bacterial endospores — •Meike Müller[1], Julia Zimmermann[2], Gregor Morfill[2], Petra Rettberg[3], and Hubertus Thomas[1] — [1]Institut für Materialphysik im Weltraum, Deutsches Zentrum für Luft- und Raumfahrt, Weßling 82234, Deutschland — [2]terraplasma GmbH, Garching 85741, Deutschland — [3]Institut für Luft- und Raumfahrtmedizin, Deutsches Zentrum für Luft- und Raumfahrt, Köln 51147, Deutschland

In space research extra-terrestrial bodies have to be protected from possible contaminations by terrestrial microorganisms. A newly developed plasma afterglow circulation apparatus is presented as a useful sterilization method for spacecraft equipment. The apparatus uses a surface micro-discharge (SMD) to create cold atmospheric plasma (CAP) and operates with ambient air and a relative humidity up to ~ 90 %. Microbiological investigations were executed to test the inactivation efficiency of the apparatus for different treatment volumes. Contact angle and XPS measurements were performed with different materials to test the material compatibility of the plasma treatment. In addition, the composition of the afterglow was analyzed for different humidity conditions and plasma parameters using Fourier Transformation Infrared (FTIR) and UV spectroscopy. The study improves the understanding of the processes which are involved in the inactivation of microorganisms and in the composition of the afterglow plasma. We will give an overview on the status of the plasma decontamination project funded by the Bavarian Ministry of Economics.

P 11.5 Di 15:15 HS 21

Inactivation Depth of *E.coli* Biofilm in Liquids by a Surface Micro-doscharge — •chen-yon tobias tschang and markus thoma — I. Physikalisches Institut, Justus-Liebig Universität Gießen

In this study, we investigated the inactivation of *Escherichia coli* (*E. coli*) biofilm under different depths below liquid surface by two modes of a surface micro-discharge (SMD). Recently, plasma liquid sterilization had been shown to be strongly effective, yet the mechanisms are complex and not well understood. Therefore, we developed a simple method to evaluate the inactivation depth of bacteria biofilm. As *E. coli* are motile bacteria, the tendency of forming biofilm on the gas-liquid interface were used to produce samples with different distance under liquid surface. The plasma source, in our study, is a SMD driven by 5 kHz sinusoidal power input with peak to peak voltage of 8 kV for ozone mode and 12 kV for nitric oxide mode. Inactivation of microbes were tested by BacTiter-Glo assay. Gas phase ozone were evaluated by UV absorption of 254 nm. Radicals in liquid were examined by indigo method for ozone and nitrite/nitrate colorimetric assay. To evaluated the inactivation effect of UV, a MgF_2 plate was applied. Results indicates different inactivation mechanism by two plasma modes. For ozone mode, the inactivation was observed stronger on liquid surface which is believed to be related to the dissolved ozone, while a relatively homogeneous inactivation was observed for nitric oxide mode.