K 5: Poster

Zeit: Dienstag 16:30–18:30 Raum: Foyer Audimax

K 5.1 Di 16:30 Foyer Audimax

Nanosecond pulsed electric fields decrease cell elasticity — •Anna Steuer[1], Malte U. Hammer[1,2], and Juergen F. Kolb[1] — [1]Leibniz Institute for Plasma Science and Technology (INP), Greifswald — [2]Center for Innovation Competence (ZIK), Greifswald

The exposure of cells to nanosecond pulsed electric fields (nsPEF) can cause different effects, depending on pulse length and field strength. Currently, nsPEF are investigated as a novel cancer therapy. As invasive cell lines generally display a lower elastic modulus than their non-invasive counterparts, we investigated the effect of nsPEF on the elasticity of rat liver epithelial WB-F344 cells in a monolayer and compared the elasticity to untreated cells and their tumorigenic counterpart WB-ras. Force-distance curves were recorded with an atomic force microscope (AFM) and the applied force was plotted against indentation of the cantilever.

We found that cells treated with 20 pulses of 100 ns and 20 kV/cm have almost the same elasticity as the tumorigenic WB-ras cells but are softer than untreated WB-F344 cells. Furthermore, we stained the actin cytoskeleton and performed a soft agar colony formation and a migration assay. Preliminary results did not show any changes. Although cell elasticity is decreased after nsPEF treatment, cells seem not to become tumorigenic or migrate faster.

K 5.2 Di 16:30 Foyer Audimax

Combination of pulsed electric fields and non-thermal plasma jet for more effective bacterial decontamination — •Jana Kredl, Qian Zhang, Jie Zhuang, Anna Steuer, and Juergen F. Kolb — Leibniz Institute for Plasma Science and Technology (INP Greifswald e.V.)

Exposures to pulsed electric fields and non-thermal plasmas have both been investigated as methods for the inactivation of microorganisms. In our studies we have combined treatments with an argon-operated, rf-driven plasma jet (kINPen 09) with the application of pulsed electric fields of microsecond duration. Inactivation efficacy against Gram-positive Staphylococcus aureus and Gram-negative Pseudomonas aerugionsa was determined by viability counts. Treatments of 3 minutes with plasma alone, or treatments with consecutive pulsed electric fields of 100 microseconds duration and 15-kV/cm amplitude alone, were found to result in some but not complete inactivation. Conversely, a combination of treatments exhibits significant synergies versus individual treatments, resulting in a complete inactivation when bacteria suspensions are first treated with the plasma. Membrane integrity, membrane potential and intracellular ROS were studied by flow cytometry. Leakage of intracellular compounds, such as DNA and protein, was measured spectrophotometrically at 260 nm and 280 nm. The properties of the cell suspension, such as pH-value, conductivity, and RNS&ROS, were also investigated. Studies of the underlying mechanisms suggest that in the plasma activated liquid environment, cells become more vulnerable to electroporation.

K 5.3 Di 16:30 Foyer Audimax

Dielectric Investigation of Normal and Malignant Cells Exposed to Nanosecond Pulsed Electric Field — •Jie Zhuang, Anna Steuer, and Juergen F. Kolb — Leibniz Institute for Plasma Science and Technology, Greifswald, Germany

Nanosecond pulsed electric field (nsPEF) has shown its unique potential as a non-thermal tumor ablation method. A number of studies have confirmed that nsPEF can induce apoptosis of many types of cancer cells. However little is known about the responses of normal cells when exposed to apoptosis-inducing nsPEFs. For in vivo applications, this is a crucial question to answer. It is generally believed that normal and cancer cells exhibit very different dielectric characteristics which initiate different nsPEF-cell interactions and lead to different cell fate. To the best of our knowledge, this topic has not been thoroughly explored. In this study, the responses of a normal rat liver epithelial cell line (WB-F344) and its malignant counterpart (WB-ras) to nsPEFs were investigated by means of dielectric spectroscopy. Preliminary results show that normal and cancer cells exhibit significantly different dielectric characteristics. Using a well established tissue model (cell monolayer), we found that the long-term (24 hours) influence of nsPEFs on the dielectric properties of normal cells is significantly weaker than on cancer cells, suggesting normal cells recover faster from nsPEF-exposures.

K 5.4 Di 16:30 Foyer Audimax

A New Scheme for High-Intensity Relativistic Laser-Driven Acceleration of a Relativistic Electron in a Plasma — •Saltanat P. Sadykova[1], Anri A. Rukhadze[2], and T.G. Samkharadze[3] — [1]Forschungszentrum Julich, Jülich Supercomputing Center, Jülich, Germany — [2]Prokhorov General Physics Institute, Russian Academy of Sciences, Vavilov Str. 38., Moscow — [3]Moscow State University of Instrument Engineering and Computer Science Moscow

We propose a new approach to high-intensity relativistic laser-driven electron acceleration in a plasma [1]. Here, we demonstrate that a plasma wave generated by a stimulated forward-scattering of an incident laser pulse can be in the longest acceleration phase with injected relativistic beam electrons. This is why the plasma wave has the maximum amplification coefficient which is determined by the acceleration time and the breakdown (overturn) electric field in which the acceleration of the injected beam electrons occurs. We must note that for the longest acceleration phase the relativity of the injected beam electrons plays a crucial role in our scheme. We estimate qualitatively the acceleration parameters of relativistic electrons in the field of a plasma wave generated at the stimulated forward-scattering of a high-intensity laser pulse in a plasma.

[1 A. A. Rukhadze, S. P. Sadykova, T. G. Samkharadze, P. Gibbon, arXiv:1404.6589