**JAF04 Student Scientific Conference**

**What am I doing, when I am not doing nothing**

**Conference Programme:**

**2 May 2019, 8 a.m., room J1, Faculty of Science, Kotlářská 2**

**8:00 Opening**

Chair: **Lucie Krajíčková**

# Presenter: Jakub Čaloud – Simulation of cylindrical emissive probe measurement

# in plasma

# Chair: Roman Přibyl

Presenter: **Jana Jágriková** – Using MRS and fMRI techniques to unveil the dejà vu

phenomenon

Chair: **Markéta Gregorová**

Presenter: **Petr Skopal** – Ignition of capacitively coupled plasma

Chair: **Dominik Bača**

Presenter: **Zuzana Košelová -** Research on quality improvement of wood surface

by using DBD discharge

Chair: **Pavlína Kurková**

Presenter: **Richard Václavik -** Mechanical Properties of Nanolayered Ti/Ni Coatings

**Bionotes and abstracts:**

**Jakub Čaloud**

Bionote:

Jakub Čaloud is a student at Masaryk University in Brno, where he earned his Bachelor’s degree in Physics in 2018. In his thesis he studied emissive Langmuir probes in plasma. Currently he is studying Plasma Physics at the same university and doing a research in runaway electrons energy measurements in tokamak fusion plasma.

# Abstract: Simulation of cylindrical emissive probe measurement in plasma

Simulation of cylindrical emissive probe measurement in plasma Emissive Langmuir probes have been used for over 80 years as they are still used in plasma diagnostics, especially to measure the plasma potential, which is one of the most important plasma parameters. First concept of an electron emitting probe was carried out by I. Langmuir in 1923, but were not used at first due to problems with strong electron emission. Nowadays several methods of interpreting the probe measurements exist, but all of them are based on a single principle. Probe biased positively, against plasma potential, will attract emitted electrons back, whereas electrons emitted from negatively biased probe can escape the probe and be measured as an effective ion current. Apart from experimental techniques, we can study plasma using numerical simulations. Thanks to this approach, many plasma parameters, for example concentration of particles, can be measured. In this study, we used a Particle in Cell (PIC) simulation code to develop a new method for determining plasma potential from a series of probe measurements.

**Jana Jágriková**

BIO:

Jana Jágriková is currently studying Applied Biophysics at Masaryk University. She earned her Bachelor's degree in Biophysics at the same university in 2018, after successfully passing the state exam and defending her thesis under the supervision of Ing. Peter Kudlička. In her thesis, she compared the metabolic and functional changes in hippocampal structures of the brain in relation to the dejà vu phenomenon. In her current research, Miss Jágriková focuses on the validation of metrics for fMRI data quality evaluation, as part of her Master's thesis. She is currently working under the supervision of Ing. Michal Mikl, Ph.D..

ABSTRACT: **Using MRS and fMRI techniques to unveil the deja vu phenomenon**

The dejà vu phenomenon has fascinated scientists, as well as the non-scientific audience, for centuries. However, clear scientific consensus on what causes dejà vu has not been established yet. The aim of this presentation is to familiarize the listeners with the biophysical principles of this phenomenon. The research is based on evaluation of the relationship between data accommodated via methods of magnetic resonance spectroscopy (MRS) and functional magnetic resonance imaging (fMRI) in relation to dejà vu. It outlines the phenomenon itself, as well as clarifying the principles of MRS and fMRI in relation to the process of pre-processing, processing and analysing of the acquired data. For this purpose, brains of 19 subjects, both male and female, were measured using 3T MR tomographs of the CEITEC research centre. The pre-processing of the data acquired during those measurements was accomplished via computing environment MATLAB and software SPM8, SPM12 and LCmodel, or MRspa. The talk will summarize this research, as well as discussing the results, which can be used in next studies of the dejà vu phenomenon.

**Petr Skopal**

BIO:

Petr Skopal is a student at Masaryk University where he studies Plasma Physics. He earned his Bachelor degree in 2018. In his thesis he worked on simulations of cylindrical probe measurements in RF plasma under supervision of prof. RNDr. David Trunec, CSc..

At present he works on ignition of capacitively coupled plasma for his Master thesis with Doc. Mgr. Pavel Dvořák, Ph.D.

Abstract: **Ignition of capacitively coupled plasma**

Authors: Doc. Mgr. Pavel Dvořák, Ph.D.; Bc. Petr Skopal

In this thesis we study ignition of capacitively coupled plasma. This type of plasma is very common in industry, where it has many utilizations, especially then in applying thin layers and surface treatment of material. There is a trend to improve existing technological processes and with it comes a demand to be able to ignite plasma easier.

We are primarily using Langmuir probe but other probes such as double probe and double flat probe too. We are also using more types of gases for example Argon, Oxygen, Hydrogen and Nitrogen. Our interest lies mainly in studying behavior of electrons and ions of different gasses right before and after of the ignition. We are expecting that our results can clarify some questions in already existing theories of ignition of capacitively coupled plasma.

**Zuzana Košelová**

BIO:

Zuzana Košelová is a student at Masaryk University. She earned her Bachelor degree in 2018 for Nanophysics and currently she study Plasma Physics. In her thesis she worked on preparation, characterisation, and utilisation of biologically created nanostructures specialized on diatoms with Mgr. Dušan Hemzal, Ph.D..

At present, she works on plasma treatment of wood for her Master thesis with Mgr. Oleksandr Galmiz, Ph.D..

Abstract: **Research on quality improvement of wood surface by using DBD discharge**

*Bc. Zuzana Košelová, Mgr. Oleksandr Galmiz, Ph.D..*

The aim of this presentation is to familiarize the reader with our research -- like the basic procedures and use of plasma surface activation on the wood. We mainly focus on uniform activation of the surface of sample using DBD discharge. In our work, we compared surface energy (which was measured by SeeSystem and the particular value was obtained by comparison through Owens-Wendt and Acid-Base Regression) of spruce wood treated with various heat pre-treatments. Another parameters, for which we measured surface energy of sample is distance from plasma (specifically for 0; 0.15; 1mm) and exposure duration during activation. We provide suggestions, where should research continue to further investigation and better understanding the principles that cause a change in roughness and chemical composition of wood after plasma treatment. In our presentation, we show the advantages of such a modified material - applying varnish and various adhesive application.

**Richard Václavik**

Bionote:

Richard Václavik is a student at Masaryk University in Brno, where he earned bachelor’s degree in Nanotechnology in 2018. In his thesis, he studied the dependence of mechanical properties of Ti/Ni multilayer thin films on the thicknesses of constituent Ti and Ni layers. Currently he is studying Plasma physics at the same university and he continues in similar research supplemented by annealing experiments to obtain shape memory effect under the supervision of doc. RNDr. Vilma Buršíková, Ph.D.

Abstract: **Mechanical Properties of Nanolayered Ti/Ni Coatings**

The aim of the present work was to study the dependence of mechanical properties of Ti/Ni multilayer thin films on the thicknesses of constituent Ti and Ni layers. The multilayer thin films were synthesized by deposition of Ti and Ni layers alternately on single crystalline silicon substrates using direct current magnetron sputtering method. Thicknesses of Ti and Ni layers varied from 1.7 nm to 100 nm. The micro-structure of the multilayer films was studied using X-ray diffraction technique, scanning electron microscopy with focused ion beam and transmission electron microscopy. Mechanical properties obtained from nano- indentation experiments and advanced techniques as micro-pillar compression and dynamic mechanic analysis were discussed in relation to microstructural observations with unique results. Moreover, multilayers were exposed to annealing treatment to promote crystallization and obtain shape memory effect. Microstructural surface changes were investigated with X-ray diffraction and atomic force microscopy.