Eva Štěpanovská

Nationality: Czech **Date of birth:** 12 Jul 1994 **Gender:** Female

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WORK EXPERIENCE

Researcher

Nuclear Physics Institute of the CAS [1 May 2020 – Current]

City: Husinec-Řež | **Country:** Czechia

- Material research was conducted at the Tandetron Laboratory using the linear accelerator Tandetron 4130MC.
- Utilization of energetic ion beams for material research.

Research assistant

Faculty of Science, University J. E. Purkyně [2018 – 2020]

City: Ústí nad Labem | **Country:** Czechia

- Creation of polymer nanofibers using the electrostatic spinning process with the Nanospider^{TM} apparatus.
- Modification of polymer nanofibers using atmospheric plasma.

INTERNSHIP

[3 Apr 2023 – 30 Jun 2023]

Helmholtz-Zentrum Dresden Rossendorf (HZDR)

- Internship as part of doctoral studies at the Jan Evangelista Purkyně University in Ústí nad Labem.
- Expanding knowledge in the field of linear accelerators, ion analytical methods, and others.
- Participation in optimizing the Electron Beam Ion Trap (EBIT) instrument.

Link: https://www.hzdr.de/db/Cms?pNid=0

EDUCATION AND TRAINING

Doctoral studies (PhD)

Jan Evangelista Purkyne University, Faculty of Science, Department of Physics [28 Mar 2022 – Current]

City: Ústí nad Labem | **Country:** Czechia | **Website:** https://www.ujep.cz/cs/ | **Field(s) of study:** Applied Ion Technology | **Thesis:** Modification of Polymer and Graphene-like Materials by Energetic Ion Beams for Their Application in Energy Storage

Master's Studies (Mgr.)

Jan Evangelista Purkyne University, Faculty of Science, Department of Physics [2019 – 2022]

City: Ústí nad Labem | **Country:** Czechia | **Website:** https://www.ujep.cz/cs/ | **Field(s) of study:** Applied Nanotechnology | **Thesis:** Functionalization of nanotextiles using energetic ions with a focus on modifying electrical properties.

- Expansion of physical and technical knowledge within nuclear and particle physics, including ion analytical methods at the linear accelerator Tandetron 4130 MC at the Institute of Nuclear Physics of the Czech Academy of Sciences.
- Modification of polymer nanofibers using energetic ion beams through ion implantation.
- Expansion of knowledge in the field of spectroscopic and ion methods.
- Focus on investigating changes in the electrical properties of polymer materials.

- The results of the master's thesis were presented at the ANPC conference (see the Conferences and Seminars section).
- A specialized publication was published based on the results of the master's thesis: "Properties of polyamide 6 and polyvinylidene fluoride nanofibers irradiated by H^+ ions."

Bachelor (Bc.)

Jan Evangelista Purkyne University, Faculty of Science, Department of Physics [2016 – 2019]

City: Ústí nad Labem | **Country:** Czechia | **Website:** https://www.ujep.cz/cs/ | **Field(s) of study:** Nanotechnology | **Thesis:** Plasma modification of PVDF electrospun membrane

- Optimization of parameters and preparation of polymer nanofibers using the NanospiderTM electrostatic spinning machine.
- Surface modification of polymer nanofibers using dielectric barrier discharge (DBD).
- As part of the bachelor's thesis, a specialized publication was written (see the Publications section): "Effect of low energy plasma treatment on surface chemistry and phase composition of electrospun polyvinylidene fluoride membrane."

PROJECTS

[20 Dec 2023 – Current]

Advanced Multiscale Materials Key Enabling Technologies (AMULET) Research in the field of 2D materials, especially graphene-like materials, surface modification of materials using ion beams, focusing primarily on applications in energy storage, hydrogen production, enhancing photocatalytic properties for sensing, optical, and electronic applications.

[2023 – Current]

Student Grant Competition (SGS)

- Team leader in the project titled: "Modification of graphene oxide and polymer films by energetic ion beams for their use in lithium batteries."
- The project focuses on comprehensive modification of organic materials not only by ion beams, which could be a suitable replacement for anodes and separators in Li-ion and Li-poly batteries.
- In 2024, the project won 1st place in the Best SGS Project competition for the Faculty of Science at UJEP.

[2023 – Current]

Japan Society for the Promotion of Science (JSPS)

- Project Title: Metal-fullerene nanocomposites: synthesis, characterization, and application in all-solid-state Li-ion batteries.
- The project is conducted in collaboration with Nagaoka University (Japan), where a part of the project will be carried out.
- The project focuses on the synthesis of thin metal/fullerene hybrid films and their application in energy storage systems. It involves the synthesis of binary composites based on C60 and selected metals, characterization of their structure and morphology, and subsequent use as electrodes in thin-film lithium-ion batteries (ASSLIB). Ion and laser beams, and/or thermal annealing will be used to adjust the parameters of the composites. The results will be published in high-impact journals as joint articles.

Link: https://www.jsps.go.jp/english/e-programs/

[2023 – Current]

ReMade@ARI

- The project focuses on developing materials for the circular economy.
- Participation in the project involves creating graphical representations of ion analytical methods used at the Institute of Nuclear Physics of the Czech Academy of Sciences in the Tandetron Laboratory, as well as publishing popular educational content for the public.

[2022 – Current]

GAČR

- Project Number: 23-06702S
- Project Title: Graphene oxide electronic structure modulation by intentional doping and defect introduction by ion beams for microelectronics, catalysts, and sensors (2023-2025).

[2022 – 2024]

GAČR

- Project Number: 22-10536S
- Project Title: Advanced hierarchical nano/microstructures for microfluid and lab-on-chip applications prepared by electron and 3D ion beam lithography (2022-2024).

[2021 – 2023]

Student Grant Competition (SGS)

- Team member under the leadership of RNDr. Petr Malinský, PhD. in the project titled: Preparation of polymer and graphene oxide-based micro-sensors and micro-capacitors using ion lithography.
- Participation in the project involved the implementation of ion implantation (Cu+, Au+) at the Institute of Nuclear Physics of the Czech Academy of Sciences, as well as the execution of ion analytical methods and other spectroscopic, microscopic, electrical, or photocatalytic analyses, including the compilation of scientific publications.

[2018 – 2020]

NanoEnviCz Development and characterization of nanofiber materials and nanocomposites with polymer nanofibers, polymer functional nanopatterns chemically modified for specific functions, and plasma technologies for creating functional nanolayers and nanopatterns.

CONFERENCES AND SEMINARS

[3 Nov 2024 – 8 Nov 2024] Tampa, Florida

AVS70 Active appearance at the conference with a contribution: "Electrical and Electrochemical Properties of Multi-energy Implanted Graphene and COC polymer layers for their use in Lithium Battery Application".

Link: https://avs70.avs.org/

[23 Sep 2024 – 27 Sep 2024] Thessaloniki, Greece

Applied Nuclear Physics 2024 Active appearance at the conference with a contribution: "Multi-energy implantation of Cu^+ and Ag^+ ions into PI and PMMA polymers: Analysis of electrical properties and potential for use in lithium batteries".

Link: https://hnps.eu/ANP2024/

[7 Oct 2023 – 13 Oct 2023] Toyama, Japonsko

IBA&PIXE2023

- Participation in a conference with a conference paper titled: "Modification of graphene and polymer thin films by multi-energy implantation of Cu+ and Ag+ ions for their use in Li-ion batteries."
- Preparation of a scientific publication for the year 2024.

Link: https://ion-beam.jp/IBAPIXE2023/

[17 Jul 2022 – 23 Jul 2022] Sibiu, Rumunsko

14th European Conference on Accelerators in Applied Research and Technology (ECAART14)

- Participation in a conference with a conference contribution titled: "The electrical and catalytic properties of graphene oxide and polyimide implanted by 1500 keV Cu ions."

Link: https://ecaart14.nipne.ro/

[12 Sep 2021 – 16 Sep 2021] Prague, Czech Republic

Applied Nuclear Physics Conference (ANPC)

- Participation in a conference with a conference paper titled: "Properties of polyamide 6 and polyvinylidene fluoride nanofibers irradiated by H+ ions."

Link: https://www.anpc2021.cz/

PUBLICATIONS

[2024]

The Electrical, Photo-catalytic and Sensory Properties of Graphene Oxide and Polyimide Implanted by Low- and Medium-Energy Silver Ions

- Article under review.
- Published in Nuclear Instruments and Methods in Physics Research, Section B (NIM B).

Novák J., Štěpanovská E., Mazánek V., et al.

[2023]

The Catalytic, Sensory and Electrical Properties of GO, PI and PLLA Implanted by Low-Energy Copper Ions The study focused on the modification of graphene oxide (GO), poly(lactic acid) (PLLA), and polyimide (PI) using low-energy Cu ions with an energy of 20 keV to investigate their catalytic, sensing, and electrical properties. Implantation into GO and polymer samples with various fluences of Cu ions was performed, followed by studying changes in their structure and composition. Electrical conductivity increased with increasing fluence of Cu ions. GO and PI demonstrated effective sensing and photocatalytic activity, with the best result achieved for a fluence of Cu ions of 3.75×10^{12} cm^{-2}.

Novák J., Štěpanovská E., Mazánek V., et al.

[2023]

Graphene Oxide and Polymer Humidity Micro-Sensors Prepared by Carbon Beam Writing In this study, new flexible humidity microsensors were directly fabricated in graphene oxide (GO) and polyimide (PI) using ion beam writing without further modifications. These microsensors were successfully tested in an atmospheric chamber. Low fluences of carbon ions were used, and structural changes in the materials were expected. The sensing performance was tested at various relative humidities and proved to be highly sensitive and stable. This new approach has great potential for various industrial applications.

Malinský P., Romanenko O., Havránek V., Stepanovska E., et al.

[2023]

The Sensory and Photo-catalytic Properties of Graphene Oxide and Polyimide Thin Films Implanted by 1500 keV Cu Ions This work investigates the modification of thin layers of polyimide (PI) and graphene oxide (GO) using accelerated Cu ions with an energy of 1.5 MeV. Changes in elemental, chemical, structural, and electrical properties were studied at various ion fluences. Expected modifications included the creation of an electrically conductive network and improvement of photocatalytic properties.

Štěpanovská E., Novák J., Malinský P., Marvan P., Sofer Z., Macková A.

[2022]

The Multi-energetic Au Ion Implantation of Graphene Oxide and Polymers The study investigates the electrical properties of polymers after their multi-energetic modification by ion implantation of Au ions. Properties of graphene oxide (GO), polyimide (PI), polyethylene terephthalate (PET), and poly(lactic acid) (PLLA) were studied after ion implantation with different energies (3.2, 1.6, 0.8 MeV). Implantation resulted in a decrease in the sheet resistance of materials, with the ascending order of energies having a greater effect on conductivity enhancement than the descending order.

Malinský P., Novák J., Štěpanovská E., Slepička P., Švorčík V., et al.

[2022]

Properties of Polyamide 6 and Polyvinylidene Fluoride Nanofibers Irradiated by H+ Ions The work focuses on the modification of polymeric nanofibers of polyamide 6 (PA6) and polyvinylidene fluoride (PVDF) through ion implantation of H^+ ions. Ion implantation alters the structure and composition of nanofibers, thereby affecting their functional properties. Experiments with various ion fluences were conducted, and changes were monitored using methods such as Rutherford Backscattering Spectrometry (RBS), Elastic Recoil Detection Analysis (ERDA), and X-ray Photoelectron Spectroscopy (XPS). The observed changes led to an increase in the electrical conductivity of the materials.

Štěpanovská E., Malinský P., Matoušek J., Poustka D., Macková A.

[2021]

Effect of Low Energy Plasma Treatment on Surface Chemistry and Phase Composition of Electrospun Polyvinylidene Fluoride Membrane This work investigated the key role of plasma power in treating polymeric nanofibers. The main advantages of low-energy plasma using a homogeneous electric field were analyzed in detail. The study focused on the influence of plasma power on nanofiber treatment and also on the benefits of low-energy atmospheric plasma.

Effect of low energy plasma treatment on surface chemistry and phase composition of electrospun polyvinylidene fluoride membrane. In Surfaces and Interfaces (Vol. 22, p.100900). Elsevier BV., IF: 3.6

Kormunda, M., Štěpanovská, E., et al (2021).

VOLUNTEERING

Ústí nad Labem

Open Day at the Faculty of Science, UJEP

- Presentation for prospective students of fields under the Department of Physics.
- Participation lasted one day each year (2018, 2019, 2020).

LANGUAGE SKILLS

Mother tongue(s): Czech

Other language(s):

English

LISTENING C1 **READING** C1 **WRITING** C1

SPOKEN PRODUCTION C1 **SPOKEN INTERACTION** C1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

HOBBIES AND INTERESTS

Rock climbing and alpinism

Running

Fitness

Box

Reading Autobiography, fantasy, novels, educational.