

Project leader: Lungu Mihail

PERSONAL DETAILS

Date and place of Birth: 01.02.1989, Romania

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Brainmap ID /Researcher ID: U-1700-032B-5263 / V-3618-2019

Researcher Website: https://www.researchgate.net/profile/Mihail_Lungu

Link to PhD Thesis: http://tomography.inflpr.ro/team/teza_eng.pdf

EDUCATION

- November 2017 - **Doctor in Physics** - Faculty of Physics, University of Bucharest (www.fizica.unibuc.ro), defended PhD thesis titled: "Surface microanalysis on plasma fusion plasma exposed materials";

- April 2014 - **M.Sc. degree** in Optics, Spectroscopy, Plasma and Lasers, Faculty of Physics, University of Bucharest (www.fizica.unibuc.ro), M.Sc. thesis titled: "Methods of production, analysis and simulation of functional materials";

- June 2012 - **Bachelor's degree (Engineer)** - Faculty of Electronics, Telecommunications & Information Technology (www.electronica.pub.ro), Bachelor's thesis titled: "The command and automatized control of the Thermoionic Vacuum Arc method for thin layer deposition process";

PROFESSIONAL EXPERIENCE

- **Scientific Researcher** - at the NILPRP, Magurele, Romania. Main activities implied: characterization of functional materials by numerous techniques such as Micro and High Energy X-ray Fluorescence (μ XRF / HEXRF), Micro X-ray Computed Tomography (μ XCT) and X-ray Laminography (XCL), Scanning electron Microscope (SEM), Glow Discharge Optical Emission Spectroscopy (GDOES) for the study of erosion and deposition phenomena on fusion relevant coated samples and superconductor internal structures; Calibration of X-ray spectroscopy methods by means of Monte Carlo simulations (photon and electron random trajectories calculation);

- **Scientific Researcher Assistant** - at the NILPRP, Magurele, Romania. Main activities implied: the use of micro X-ray fluorescence (μ XRF) and X-ray transmission (XRT) methods in the study of erosion and deposition of thin thickness coated samples; The acquisition and processing of data from microtomography analyses of carbon based composite materials and cable in conduit superconductors relevant for fusion technology;

TRAININGS

- 13th Kudowa Summer School "Towards Fusion Energy", 13-17 June 2016, Poland;

- Thermal Desorption Spectroscopy (TDS) experimental campaigns at the ENEA institute under supervision of Prof. Giorgio Madaluno, Italy, Frascati, 11-17 Oct. 2015;

- Participation at Quartz Crystal Microbalance Monitor (QCM) measurements campaigns held at Forschungszentrum (FZJ), Julich under supervision of Prof. Christian Linsmeier, Germany, Julich, 20 Sept. – 3 Oct. 2015;

- Quartz Crystal Microbalance Monitor measurements campaigns held at Technical University of Vienna (TUW), supervisor Univ. Prof. Friedrich Aumayr, Austria, 1-11 Sept. 2015;
- Participation at the „52nd Culham Plasma Physics Summer School 2015”, 13-24 July 2015, Culham, United Kingdom;
- Participation at the “IPP Summer School University for Plasma Physics and Fusion Research in Garching”, Munich, 15-19 September 2014;

TECHNICAL QUALIFICATIONS

- Primary used methods / simulations: Advanced microstructural characterization of materials and processes by X-ray tomography / laminography; X-ray fluorescence method for quantitative and qualitative measurements; Monte Carlo simulations for photon and electron trajectory predictions. Additional material characterization techniques: Glow Discharge Optical Emission Spectroscopy-GDOES; X-ray Diffraction-XRD, Scanning Electron Microscopy-SEM, Energy Dispersive X-ray Spectroscopy-EDX, Atomic Force Microscopy-AFM, Microindentation hardness testing.

FOREING LANGUAGES: English;

EXPERIENCE IN INTERNATIONAL RESEARCH PROJECTS:

- X-ray microtomography for porosity characterizations of CFC samples, WP13-IPH-A03-P1-01/MEdC (BS_20A), FP7-EURATOM, participant 2013;
- Erosion analysis for nanocomposite layers by means of high-resolution absorption and X-ray fluorescence, WP13-IPH-A01-P1-01 (BS_20B) FP7-EURATOM, participant 2013;
- Erosion and deposition studies on plasma facing components integrated in JET tokamak, JW13-NFT-MEC-33 (BS_20C), FP7-EURATOM fusion, participant 2013;
- Romania's participation in EUROfusion WPJET2 and complementary research /WPJET2-RO, WPJET2_P and WPJET2_C, FP8-EURATOM, participant, 2014;
- Romania's participation in EUROfusion WPMAT and complementary research /WPMAT-RO, WPMAT_C, FP8-EURATOM, participant, 2014;
- Romania's participation in EUROfusion WPPFC and complementary research /WPPFC-RO, WPPFC_P, FP8-EURATOM, participant 2014;
- Romania's participation in EUROfusion WPEDU and complementary research /WPEDU-RO, WPEDU_P, FP8-EURATOM, participant 2015-2017;
- Romania's participation in EUROfusion WPJET4 and complementary research /WPJET4-RO, WPJET4_C, FP8-EURATOM, participant 2017;

Defining elements of the outstanding scientific achievements of the project leader

1. Articles

[1] **M. Lungu**, et al., JET-EUROfusion Contributors, “Preparation and analysis of functional fusion technology related materials”, Romanian Journal of Physics 05/2015; 60(3-4):560-572; http://www.nipne.ro/rjp/2015_60_3-4/RomJPhys.60.p560.pdf, **IF 1.398**;

Candidate contribution: The candidate chose the topic namely non-destructive testing of fusion relevant materials, conducted X-ray fluorescence measurements, defined

calibration protocols for the spectroscopy methods, determined surface mappings on investigated samples;

[2] Tiseanu, Ion; Craciunescu, Teddy; **Lungu, Mihail**; Dobrea, Cosmin, "X-ray micro-laminography for the ex-situ analysis of W-CFC samples retrieved from JET ITER-Like Wall", 2016 Phys. Scr. 2016 014050, doi:10.1088/0031-8949/T167/1/014050; **IF 1.101**;

Candidate contribution: The candidate conducted X-ray computed laminography and X-ray fluorescence measurements for surface morphology determination and layer thickness evaluation;

[3] I. Tiseanu, L. Muzzi, A. Sima, D. Dumitru, C. Dobrea, T. Craciunescu, **M. Lungu**, I. Porosnicu, V. Corato, A. della Corte, „Multi-scale 3D modelling of a DEMO prototype cable from strand to full-size conductor based on X-ray tomography and image analysis”, Fusion Engineering and Design, 18 January 2019, In Press, <https://doi.org/10.1016/j.fusengdes.2019.01.025>; **IF 1.457**; Candidate contribution: The candidate conducted multiple high resolution X-ray computed tomography measurements on DEMO prototype cables, applied post processing software algorithms on 3D reconstructions for providing high contrast tomography;

[4] C. P. Lungu, C. M. Ticos, C. Porosnicu, I. Jepu, **M. Lungu**, A. Marcu, C. Luculescu, G. Cojocaru, D. Ursescu, R. Banici, G. R. Ungureanu, „Periodic striations on beryllium and tungsten surfaces by indirect femtosecond laser irradiation”, Applied Physics Letters 104(10):101604, 2014; <https://doi.org/10.1063/1.4868241>, **IF 3.48**. The candidate conducted the fabrication process of high flux and resistant materials in Be and W configuration and applied morphology studies of the laser irradiated surface structures in order to explain the striation producing mechanisms;

[5] Avotina, L.; **Lungu, M.**; Dinca, P.; Butoi, B.; Cojocaru, G.; Ungureanu, R.; Marcu, A.; Luculescu, C.; Hapenciuc, C.; Ganea, PC.; Petjukevics, A.; Lungu, CP.; Kizane, G.; Ticos, CM.; Antohe, S., "Irradiation of nuclear materials with laser-plasma filaments produced in air and deuterium by terrawatt (TW) laser pulses", JOURNAL OF PHYSICS D-APPLIED PHYSICS volume 51, issue 2, 2018, <https://doi.org/10.1088/1361-6463/aa9b0f>, **IF 2.373**; The candidate assisted the fabrication process of the plasma facing components and provided usable analysis data determined by means of XPS, EDX and SEM measurements;

2. Books/ chapters (including monographs):

[1] **M. Lungu**, „Micro-analysis techniques for plasma facing components”, Ed. Academiei Oamenilor de Stiință din Romania 2019, ISBN: 978-606-8636-61-0;

[2] R. Vladiu, C. Porosnicu, A. Mandes, I. Jepu, V. Dinca, A. Marcu, **M. Lungu**, et al. „DLC Thin Films and Carbon Nanocomposite Growth by Thermionic Vacuum Arc (TVA) Technology” Diamond and Carbon Composites and Nanocomposites / InTech / 2016 / 978-953-51-2454-2;

Significant and representative scientific achievements

The candidate **Mihail LUNGU** has a permanent position in the X-ray Microtomography Laboratory integrated in the National Institute for Laser, Plasma and Radiation Physics (NILPRP). The candidate has been involved in the last decade in various EFDA / Eurofusion projects, providing high resolution and complex tomography analysis on high temperature superconductivity samples and applying various X-ray spectroscopy

methods for the characterization of plasma facing materials integrated in the fusion reactors. Representative scientific achievements of the candidate are:

- **Definition of protocols for evaluating the erosion and re-deposition** by means of not usually applied non-destructive techniques such as: X-ray computed microtomography (XCT), X-ray computed laminography (XCL) and X-ray microbeam fluorescence (μ XRF); **Definition of thickness and composition calibration protocols** assisted by an extended set of Monte Carlo simulations that led to complex optimizations of the deposition parameters for in Thermionic Vacuum Arc (TVA) and magnetron sputtering method; **Comprehensive mechanical-chemical studies** on fusion reactor relevant alloys or multilayer samples by means of Thermal desorption spectroscopy (TDS), Glow discharge optical emission spectroscopy (GDOES), Energy dispersive X-ray spectroscopy (EDX) and scanning electron microscope (SEM);
- **Multi-scale 3D modelling** of a DEMO prototype cable from strand to full-size conductor based on X-ray tomography and image analysis. He is in charge of performing complex tomographic scanning of strands, cables and joints. Recently the candidate implemented an in-situ setup for comparative tomography analysis of HTS-CICC cables at room and liquid nitrogen temperature.

The **PhD work had the main purpose in studying the erosion, deposition and transport phenomena of the relevant elements used as plasma facing components in the tokamak type reactors.** Similar layers with those found on the first wall of the reactors, made of pure and mixed materials were prepared. His work has contributed to several papers and presentations: **3 papers as first author in ISI papers, 27 papers as co-author in ISI papers, 3 co-author in non-ISI papers and 26 presentations at conferences (1 award for the best poster presentation at EMRS 2019), h-index 6 on WOS, 7 on SCOPUS and 5 on Google Scholar.**