LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Application of neural networks for monitoring and optimization of plasma processes

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

Plasma technologies are widely used in coating deposition, surface modification, material processing and advanced materials production, as they allow controlling the chemical and physical properties of materials with high precision. However, these processes are complex and highly dependent on various parameters, such as temperature, current strength, voltage, material introduction rate, plasma environmental conditions and experimental settings, therefore traditional monitoring and control methods are often slow, manual, require operator intervention and do not allow for real-time prediction of material properties or detection of anomalies. The integration of artificial intelligence (AI), especially deep learning, into plasma technology processes provides the opportunity to automate monitoring, analyze huge data streams from sensors, spectroscopy devices, cameras and other tools, detect anomalies and predict the final properties of materials based on various types of data. Using advanced AI platforms such as TensorFlow, PyTorch or FastAI, it is possible to significantly increase process efficiency, reduce material losses, improve process quality and accelerate the implementation of new technological solutions. Plasma process research generates large data streams, the analysis of which requires complex data processing methods, including normalization, feature extraction and data augmentation, while effective prediction, optimization and anomaly detection are still a scientific gap that hinders both industrial and academic research. The aim of this research is to develop and test deep learning tools for real-time plasma monitoring, anomaly detection and material property prediction, implementing tasks such as data collection and preparation for AI model training, development and training of neural networks for real-time predictions, integration of AI models into an experimental plasma monitoring system, assessment of prediction accuracy, hyperparameter optimization and development of recommendations for automatic correction of process parameters of the system. The expected results include an AI prototype for real-time monitoring, accurate anomaly and property prediction models, parameter analysis methodology, scientific publications in international journals and recommendations for automated process control. The innovativeness and practical benefits of the research are revealed by applying AI to real-time optimization of plasma processes, which allows for improving efficiency, increasing product quality, reducing losses, accelerating the development of advanced materials, and creating solutions that are universal for both academic and industrial research, have high scientific and practical value, and promote technological progress.

SCIENTIFIC SUPERVISOR:

Dr. Žydrūnas Kavaliauskas
Plasma Processing Laboratory

Lithuanian Energy Institute
Breslaujos 3, 44403 Kaunas
Lithuania

Zydrunas.Kavaliauskas@lei.lt

More information and the full list of offered PhD topics available at our website

https://www.lei.lt/en/phd-studies/