LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2026

DOCTORAL RESEARCH TOPIC:

Synthesis of Advanced Photocatalytic Structures for Light-Driven Clean Hydrogen Production

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

The sustainable and efficient production of hydrogen from water is one of the key challenges in achieving climate neutrality and low-carbon energy systems. Photocatalysis, which utilizes light energy to split water, is considered a promising technology; however, its efficiency is limited by insufficient light absorption of active materials, rapid charge carrier recombination, and low surface activity. Therefore, there is a need to develop advanced photocatalytic structures featuring optimized chemical and physical surface properties, improved charge separation, and enhanced stability.

The aim of the study is to develop innovative photocatalytic structures synthesized via physical deposition methods and to investigate their operational mechanisms for light-driven clean hydrogen production.

Objectives:

- to select suitable oxide, nitride, and combined materials for the formation of photocatalytic structures;
- to develop multilayer and heterostructured photocatalyst architectures by controlling their microstructure and defect formation;
- to form the structures on various types of substrates, including floating ones;
- to evaluate the chemical and surface properties of the structures and their relationship with photocatalytic hydrogen generation;
- to develop a laboratory system for light-driven hydrogen production and to assess the activity and stability of the synthesized structures;
- to analyse the key charge-transport and surface-reaction factors governing efficient hydrogen evolution;
- to evaluate the potential use of the generated hydrogen by integrating it into a low-power fuel cell and assessing its energy conversion efficiency.

Expected results – new photocatalytic structures with improved light absorption, charge separation efficiency, and surface activity, enabling increased hydrogen production rates and enhanced stability. The study is expected to yield original insights into the operational

SCIENTIFIC SUPERVISOR:

Dr. Marius Urbonavičius
Center for Hydrogen Energy Technologies

Lithuanian Energy Institute
Breslaujos 3, 44403 Kaunas
Lithuania

Marius.Urbonavicius@lei.lt

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