Catalogue of Hydrogen Research in the Czech Republic

The Evolution and Importance of Hydrogen Research in the Czech Republic

HYTEP
CZECH HYDROGEN TECHNOLOGY PLATFORM
SINCE 2007

Co-funded by
the European Union

Project “Coordination activity of the Czech Hydrogen Technology Platform 2027”
CZ.01.01.01/07/24_052/0005624

Content

The Evolution and Importance of Hydrogen Research in the Czech Republic

Although hydrogen technologies present a forward-looking approach to decarbonization and future energy security, substantial scientific and technical challenges must be addressed in order to achieve their widespread adoption. The hydrogen economy spans four functional areas: production, storage, transportation and use; each area has its special set of grand technical challenges. Recent advances in materials science, chemistry, physics, biology, computation, and nanoscience provide considerable promise for breaking through many of these current barriers. These advances underpin our vision and provide confidence that the widespread use of hydrogen outside current uses is achievable. The aim of the *Catalogue of Hydrogen Research in the Czech Republic* is to facilitate the networking of Czech and foreign researchers and to facilitate the search for the right partners in various areas of hydrogen research, development and innovation.

Hydrogen research in Czechia has a long and fascinating history, marked by both early innovation and modern advancements. This journey underscores the country's commitment to sustainable energy solutions and highlights its growing role in the global hydrogen economy.

Early Beginnings

Hydrogen research in Czechia can be traced back to the mid-20th century, when the Czechoslovak engineering company ČKD (Českomoravská-Kolben-Daněk) Semiconductor Division realized 1 kW alkaline fuel cells for locomotive propulsion. These efforts showcased remarkable ambition but faced significant challenges. In the 1970s, progress stalled due to political and economic factors. Despite this pause, the early 2000s marked a revival of hydrogen research in Czechia, aligning with global efforts to reduce reliance on fossil fuels and transition to sustainable energy sources.

The Importance of Hydrogen Research in Czechia

Today, Czechia is home to a robust ecosystem of academic, industrial, and governmental stakeholders actively advancing hydrogen technologies. This ecosystem is characterized by cutting-edge research, international collaborations, and practical applications.

Hydrogen holds immense potential as a versatile energy carrier. Its applications span across industries, from decarbonizing transport and industry to enabling long-term energy storage and reducing greenhouse gas emissions. Hydrogen research is essential not only for environmental sustainability but also for energy security and economic competitiveness. As the world transitions to a low-carbon economy, countries that invest in hydrogen technologies are likely to benefit from new markets, jobs, and technological leadership.

One of the advantages of Czech hydrogen research is deep knowledge in industrial processes connected with hydrogen as industrial chemistry, machining, gas transportation and storage, nuclear research etc. This background allows Czech research institutions to implement unique knowledge into newly developed products and processes. As example heavy truck Tatra for extreme conditions can be mentioned.

For Czechia, hydrogen offers a pathway to reduce dependency on imported fossil fuels, enhance the resilience of its energy systems, and meet ambitious climate goals. By integrating hydrogen into its governmental strategies, Czechia can position itself as a hub for innovation and a model for other countries aiming to decarbonize their economies.

The Role of International Cooperation

International cooperation is a cornerstone of hydrogen research and development. Collaborative projects like RegioHyt and NEXTAEC illustrate the value of pooling expertise, resources, and funding to achieve breakthroughs that no single country could accomplish alone. Czechia's partnerships with leading institutions in countries such as Norway, Germany, Denmark, and South Korea demonstrate its active role in the global hydrogen community.

These collaborations accelerate the development of advanced technologies, such as efficient electrolyzers and hydrogen storage systems, while fostering knowledge exchange and capacity building. Moreover, international projects confirm Czechia as a credible partner in the global hydrogen economy, attracting investments and creating opportunities for local businesses and researchers.

Czech Hydrogen Technology Platform – your contact point

The Czech Hydrogen Technology Platform (HYTEP) aims to connect research and development with business partners, foster mutual awareness among entities involved in hydrogen technologies, and undertake initiatives to enhance the potential of hydrogen applications in the Czech Republic, aligning with the climate goals of the European Union and its Member States.

HYTEP is a main national contact point helping you to find a suitable partners for planned research and development.

Contact persons
Pavel Podaný; Pavel Konopík; Pavel Šuchmann
pavel.podany@comtesfht.cz; pavel.konopik@comtesfht.cz; pavel.suchmann@comtesfht.cz

EN

COMTES FHT a. s.

CZ

COMTES FHT a. s.

Type of the organisation

Company; Research institute

Organisation activity

6 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen production

Hydrogen distribution and storage

- Hydrogen storage
- Hydrogen gas grid
- Refueling station
- Hydrogen carriers
- Other hydrogen distribution and storage

Hydrogen end-use

- Power and heat
- Mobility
- Industry
- Mobile devices
- Fuel cells and fuel cells materials
- Other hydrogen end-using

Hydrogen service provision

- Safety
- Codes and standards

https://www.comtesfht.com

Others including cross-cutting research directions

We are an R&D center with extensive technical expertise, dedicated to delivering comprehensive solutions to complex material and technological challenges. Our cutting-edge facilities include, as an example, advanced 3D printers, melting furnaces, and universal mechanical testing machines for both static and dynamic tests, supported by Digital Image Correlation (DIC).

In the field of hydrogen technologies, we focus on the development of innovative materials with enhanced properties, such as improved strength and resistance to hydrogen embrittlement. Additionally, we conduct specialized tests to detect hydrogen embrittlement, including experiments in electrolytes and under pressurized hydrogen conditions.

We actively drive innovation in industries such as automotive, aerospace, and energy, empowering our partners to achieve outstanding results through advanced research and development.

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Zmeko, J.; Konopík, P. *Comparison of the Effects of Hydrogen Embrittlement in Electrolytic and Compressed Gas Environments*. In Proceedings of the 2024 International Conference on Materials, COMAT 2024; TANGER: [Online]. Available online: https://comat2024.tanger.cz/cz/
- Konopík, P.; Zmeko, J. *Comparison of Two Methods of In-Situ Tensile Tests Simulating Hydrogen Embrittlement of 42CrMo4 Steel*. In Proceedings of the 2024 International Conference on Hydrogen Embrittlement, Srní 2024; [Online]. Available online: https://srni.vzuplzen.cz/wp-content/uploads/2024/11/Sbornik-Srni2024.pdf

Functional Samples

- *Station for Hydrogen Charging of Hollow Test Specimens Pressure.* Authors: Jan Zmeko, Václav Brunát, Pavel Konopík. Created in 12/2024, COMTES FHT
- *Clamping System for Hollow Test Specimens with Internal Hydrogen Pressure.* Authors: Jan Zmeko, Václav Brunát, Jindřich Vokáč, Pavel Konopík. Created in 12/2024, COMTES FHT

Grant schemes

- Research Proposal Submitted: Research and Development of High-Strength Steel for the Production of Cylinders for Industrial Gases and with the Potential for Hydrogen Storage up to 300 Bar (FW12010174). Currently under evaluation in the following call: Technological Agency of the Czech Republic (TA ČR), FW-TREND, 12th Public Competition of the TREND Programme, Subprogramme 1 "Technological Leaders."
- Testing in Specialized Environments: Hydrogen and Autoclave Conditions – Internal Research Program within the institutional support for the long-term conceptual development of the research organization (decision no. 3/2023 of the Ministry of Industry and Trade of the Czech Republic)

Contact person
Rastislav Toman
rastislav.toman@cvut.cz

EN

Czech Technical University in Prague, Faculty of Mechanical Engineering

CZ

České Vysoké Učení Technické v Praze, Fakulta Strojní

Type of the organisation

Public university

Organisation activity

5 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen distribution and storage

Refueling station

Hydrogen end-use

Mobility

Fuel cells and fuel cells materials

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Kyjovský, Š.; Vávra, J.; Bortel, I.; Toman, R.
  Drive cycle simulation of light duty mild hybrid vehicles powered by hydrogen engine
  International Journal of Hydrogen Energy. 2023, 48(44), 16885-16896. ISSN 0360-3199.
  https://www.sciencedirect.com/science/article/pii/S0360319923002252
- Patents

Grant schemes

- TN02000054 – Národní centrum kompetence inženýrství pozemních vozidel Josefa Božka
  Božek Vehicle Engineering National Center of Competence
  (2023–2028, TA0/TN)

https://fs.cvut.cz

Contact person
Tomáš Němec
nemec@it.cas.cz

INSTITUTE OF THERMOMECHANICS
CZECH ACADEMY OF SCIENCES

EN

Institute of Thermomechanics of the CAS

CZ

Ústav termomechaniky AV ČR, v. v. i.

Type of the organisation

Research institute

Organisation activity

2 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Fuel cells and fuel cells materials: catalytic materials / layers

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Němec T., Šonský J., Gruber J., de Prado E., Kupčík J., Klementová M., Platinum and platinum oxide nanoparticles generated by unipolar spark discharge. Journal of Aerosol Science, 141, March (2020), 105502

Patents

- Czech utility model PUV 2021-39298 Equipment for applying functional layers of catalytic nanomaterials
- Pending Czech patent application PV 2021-488 A method of applying functional layers of catalytic nanomaterials, a device for this and a catalytic layer prepared using this method
- Expired Czech utility model PUV 2020-37288 High voltage source for generating a spark discharge
- Expired Czech patent PV 2020-565 Fuel cell distribution board

Grant schemes

- Co-investigator: 2024–2029: Advanced Hydrogen Compression Technology – Electrochemical Compression, provider: Technology Agency of the Czech Republic
- Sub-programme coordinator: Hydrogen Technologies: 2022–2026: Strategy AV21 Sustainable Energy programme, provider: Academy of Sciences of the Czech Republic
- Co-investigator: 2022–2024: Development of high performance extended range EV boat, provider: Technology Agency of the Czech Republic
- Co-investigator: 2020–2022: Development of high-performance catalyst materials and high-durability metallic plates for intelligent automated manufacturing of fuel cell stacks, provider: Technology Agency of the Czech Republic

https://www.it.cas.cz

Contact person
Pavel Srbecký
pavel.srbecky@nanoadvanced.cz

EN

NANO Advanced s. r. o

CZ

NANO Advanced s. r. o.

Type of the organisation

Company

Organisation activity

3 How many people are currently involved in hydrogen research within your organisation?

Expertise and main sectors of your hydrogen research

Hydrogen production

https://www.nanoadvanced.cz

Contact person
Karin Stehlík
karin.stehlik@net4gas.cz

EN

NET4GAS s. r. o.

CZ

NET4GAS s. r. o

Type of the organisation

Company

Organisation activity

10 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen gas grid

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications (not publicly available):

- Impact of hydrogen on safety zones along gas transport infrastructure (NET4GAS, TUL, VSCHT)
- Impact of increased flow velocity due to hydrogen transport on existing gas transport pipelines (NET4GAS, ZCU)
- Hydrogen compatibility assessment of material of existing gas transport pipelines (NET4GAS, SVUM, MMV)
- Hydrogen compatibility assessment of sealants and lubricants used in existing gas transport pipelines (NET4GAS, Fraunhofer)
- Assessment of hydrogen tightness of existing gas transport infrastructure (NET4GAS)

https://www.net4gas.cz/en/home/

Contact person
Sarka Houdkova
houdkova@vzuplzen.cz

EN

CZ

Research and Testing Institute Plzen, Ltd.

Výzkumný a zkušební ústav Plzeň, s. r. o.

Type of the organisation

Company; Research institute

Organisation activity

10 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen distribution and storage

Hydrogen storage: material degradation and protection

Hydrogen gas grid: material degradation and protection

Refueling station: functional mathematical model of filling tanks, or any other containers, with hydrogen

Hydrogen end-use

Mobility: multibody models of public transport vehicles

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Pavel Polach, Jaroslav Václavík, Multibody models of the triple hybrid hydrogen fuel cell bus and their experimental verification, EAN 2011: 49th International Scientific Conference on Experimental Stress Analysis Pages 325 - 3322011 49th International Scientific Conference on Experimental Stress Analysis, EAN 20116 June 2011 through 9 June 2011 Code 106810
- Hana Jirková, David Aišman, Marie Frank Netrvalová, Šárka Houdková: Identification of the Effect of Hydrogen as a fumction of Structural Condition in Pipeline Distribution Infrastructure and Storage Tanks, Sborník z 18. konference Životnost komponent energetických zařízení, Srní, 17.–19. října 2023 (in Czech)
- Hana Jirková, Josef Duliškovič, David Aišman and Josef Kasl: Hydrogen Embrittlement of X52 Electrolytically Charged Pipeline Steel, Contribution of Metallography to Production Problem Solutions, under review
- Žaneta Dlouhá, Jiří Frank, Josef Duliškovič, Hana Jirková and Šárka Houdková: Application of Cold Spray protective coating on steel used in the pipeline industry, Contribution of Metallography to Production Problem Solutions, under review

https://www.vzuplzen.cz/en

Grant schemes

- OP TAK Application III EG20_321/0025011: Mobile hydrogen filling station, 2021–2023
- MPO FR-TI2/442 – Research and development of advanced hydrogen technologies for energy and transport, 2010–2013
- PŽSS06020165: Mapping the impacts of efforts to reduce greenhouse gas emissions using hydrogen admixtures on the vitality of the existing infrastructure of gas power plants (HYGAS); 2023–2025
- TH83020002: Identification of the influence of hydrogen depending on the structural condition of the pipeline distribution infrastructure and storage tanks (HOOPLA); 2023–2026

Contact person
Mgr. Vlastimil Sram, MBA
vlastimil.sram@cz.bosch.com

EN

Robert Bosch, spol. s r. o.

CZ

Robert Bosch, spol. s r. o.

Type of the organisation

Company

Organisation activity

100 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen production

Hydrogen end-use

- Power and heat
- Mobility
- Industry
- Fuel cells and fuel cells materials

Hydrogen service provision

- Codes and standards

Others including cross-cutting research directions

- Water purification for hydrogen production

https://www.bosch-hydrogen-energy.com

Contact person
Ivo Hain
hain@svum.cz

EN

SVUM a. s.

CZ

SVÚM a. s.

Type of the organisation

Research institute

Organisation activity

20 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen distribution and storage

Fuel cells and fuel cells materials

https://www.svum.cz

Contact person
Bronislav Vahalík
bronislav.vahalik@cdv.cz

EN

CZ

Transport research centre

Centrum dopravního výzkumu, v. v. i.

Type of the organisation

Research institute

Organisation activity

9 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen production

Hydrogen distribution and storage

- Hydrogen storage
- Hydrogen gas grid
- Refuelling station
- Hydrogen carriers

Mobility

Codes and standards

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Přikryl, V., Vahalík, B., & Poul, A. (2024). Plug-in Fuel Cell Electric Vehicle Concept in Relation to Driving Practices in the Czech Republic. Transactions on Transport Sciences. ISSN 1802-9876
- Špička, L. et al. (2024). Syntetická paliva pro dopravu (Synthetic fuels for transport). ISBN 978-80-88655-31-2

Grant schemes

- National Hydrogen Mobility Center (NAHYC-m) TN02000007
- Progressive development of hydrogen economy in transport in the Czech Republic CK02000044

https://www.cdv.cz

Contact person
Prof. Dr. Ing. Karel Bouzek
karel.bouzek@vscht.cz

UCT PRAGUE

EN

CZ

University of chemistry and technology, Prague

Vysoká škola chemicko-technologická v Praze

Type of the organisation

Public university

	Organisation activity
40	**How many people are currently involved in hydrogen research within your organisation?**
	Expertise and main sectors of your hydrogen research
	Hydrogen production
	Hydrogen distribution and storage
	Hydrogen storage
	Hydrogen gas grid
	Hydrogen carriers
	Power and heat
	Mobility
	Industry
	Mobile devices
	Fuel cells and fuel cells materials
	Other hydrogen end-use
	Others including cross-cutting research directions
	Education

https://www.vscht.cz

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Bianca, G., et al., Liquid-phase exfoliated gese nanoflakes for photoelectrochemical- type photodetectors and photoelectrochemical water splitting. ACS Applied Materials and Interfaces, 2020. 12(43): p. 48598–48613
- Browne, M.P., E. Redondo, and M. Pumera, 3D Printing for Electrochemical Energy Applications. Chemical Reviews, 2020. 120(5): p. 2783-2810
- Hnát, J., M. Paidar, and K. Bouzek, Hydrogen production by electrolysis, in Current Trends and Future Developments on (Bio-) Membranes: New Perspectives on Hydrogen Production, Separation, and Utilization. 2020. p. 91–117
- Miller, H.A., et al., Green hydrogen from anion exchange membrane water electrolysis: A review of recent developments in critical materials and operating conditions. Sustainable Energy and Fuels, 2020. 4(5): p. 2114–2133
- Bohackova, T., J. Ludvik, and M. Kouril, Metallic material selection and prospective surface treatments for proton exchange membrane fuel cell bipolar plates – a review. Materials, 2021. 14(10)
- Brauns, J., et al., Evaluation of diaphragms and membranes as separators for alkaline water electrolysis. Journal of the Electrochemical Society, 2021. 168(1)
- Browne, M.P., et al., Oxygen evolution catalysts under proton exchange membrane conditions in a conventional three electrode cellvs.electrolyser device: a comparison study and a 3D-printed electrolyser for academic labs. Journal of Materials Chemistry A, 2021. 9(14): p. 9113–9123
- Ďurovič, M., J. Hnát, and K. Bouzek, Electrocatalysts for the hydrogen evolution reaction in alkaline and neutral media. A comparative review. Journal of Power Sources, 2021. 493
- Edelmannová, M., M. de los Milagros Ballari, M. Přibyl, and K. Kočí, Experimental and modelling studies on the photocatalytic generation of hydrogen during water-splitting over a commercial TiO2 photocatalyst P25. Energy Conversion and Management, 2021. 245
- Henkensmeier, D., et al., Overview: State-of-the Art Commercial Membranes for Anion Exchange Membrane Water Electrolysis. Journal of Electrochemical Energy Conversion and Storage, 2021. 18(2)
- Najibah, M., et al., PBI nanofiber mat-reinforced anion exchange membranes with covalently linked interfaces for use in water electrolysers. Journal of Membrane Science, 2021. 640
- Plevová, M., J. Hnát, and K. Bouzek, Electrocatalysts for the oxygen evolution reaction in alkaline and neutral media. A comparative review. Journal of Power Sources, 2021. 507
- Pushkarev, A.S., et al., On the influence of porous transport layers parameters on the performances of polymer electrolyte membrane water electrolysis cells. Electrochimica Acta, 2021. 399
- Vaněčková, E., et al., Electrochemical Reduction of Carbon Dioxide on 3D Printed Electrodes. ChemElectroChem, 2021. 8(11): p. 2137–2149
- Zabelina, A., et al., Surface plasmon-polariton triggering of Ti3C2T: X MXene catalytic activity for hydrogen evolution reaction enhancement. Journal of Materials Chemistry A, 2021. 9(33): p. 17770–17779
- Zoller, F., et al., Carbonaceous Oxygen Evolution Reaction Catalysts: From Defect and Doping-Induced Activity over Hybrid Compounds to Ordered Framework Structures. Small, 2021. 17(48)
- Carda, M., et al., Impact of Preparation Method and Y2 O3 Content on the Properties of the YSZ Electrolyte. Energies, 2022. 15(7)
- Carda, M., D. Budáč, M. Paidar, and K. Bouzek, Current trends in the description of lanthanum strontium manganite oxygen electrode reaction mechanism in a high-temperature solid oxide cell. Current Opinion in Electrochemistry, 2022. 31
- Jiang, T., et al., One step electrochemical fabrication of high performance Ni@Fe-doped Ni(oxy) hydroxide anode for practical alkaline water electrolysis. Journal of Materials Chemistry A, 2022. 10(44): p. 23863–23873

- Li, T., et al., Two-dimensional materials for electrocatalysis and energy storage applications. Inorganic Chemistry Frontiers, 2022. 9(23): p. 6008–6046
- Plevová, M., et al., Optimization of the membrane electrode assembly for an alkaline water electrolyser based on the catalyst-coated membrane. Journal of Power Sources, 2022. 539
- Zabelin, D., et al., A surface plasmon polariton-triggered Z-scheme for overall water splitting and solely light-induced hydrogen generation. Journal of Materials Chemistry A, 2022. 10(26): p. 13829–13838
- Budáč, D., et al., Prediction of Electrical Conductivity of Porous Composites Using a Simplified Monte Carlo 3D Equivalent Electronic Circuit Network Model: LSM-YSZ Case Study. Electrochimica Acta, 2023. 457
- Ďurovič, M., J. Hnát, M. Strečková, and K. Bouzek, Efficient cathode for the hydrogen evolution reaction in alkaline membrane water electrolysis based on NiCoP embedded in carbon fibres. Journal of Power Sources, 2023. 556
- Appelhaus, S., et al., Benchmarking performance: A round-robin testing for liquid alkaline electrolysis. International Journal of Hydrogen Energy, 2024. 95: p. 1004–1010
- Bawab, B., et al., Synergistic effect of Pd single atoms and nanoparticles deposited on carbon supports by ALD boosts alkaline hydrogen evolution reaction. Chemical Engineering Journal, 2024. 482
- Bera, C., et al., NiCoP fibers as novel catalysts for hydrogen evolution in alkali and acidic environment. International Journal of Hydrogen Energy, 2024. 60: p. 118–132
- Pham, T.M., et al., Oxygen-deficient annealing boosts performance of CoNiFe oxide electrocatalyst in oxygen evolution reaction. Journal of Catalysis, 2024. 438
- Zabelin, D., et al., Enhancing hydrogen storage efficiency: Surface-modified boron nanosheets combined with IRMOF-20 for safe and selective hydrogen storage. International Journal of Hydrogen Energy, 2024. 57: p. 1025–1031
- Bautkinova, T., M. Prokop, T. Bystron, and K. Bouzek, Interface between anode porous transport layer and catalyst layer: A key to efficient, stable and competitive proton exchange membrane water electrolysis. Current Opinion in Electrochemistry, 2025. 49
- 31. Najibah, M., et al., PPS-reinforced poly(terphenylene) anion-exchange membranes with different quaternary ammonium groups for use in water electrolysers. Journal of Membrane Science, 2025. 713

Patents

- **PUV 2020-37296 CS:** Zařízení pro testování úniků plynů těsněními přírubových spojů
  EN: Equipment for testing gas leaks by sealing flange joints
- **PV 2022-238 CS:** Anion-výměnný materiál na bázi blokového polymeru styrenu a olefinů
  EN: An anion-exchange material based on block polymer of styrene and olefins
- **PUV 2022-40052CS:** Systém sušení svazku palivových článků typu PEM s membránovým modulem a recirkulačním čerpadlem
  EN: PEM type fuel cell bundle drying system with membrane module and recirculation pump
- **PUV 2023-41198:** Zařízení pro odstraňování zbytkové koncentrace vodíku z inertních plynů
  EN: A device for removing residual hydrogen concentration from inert gases
- **PUV 2024-42112CS:** Katalyzátor pro kyslíkovou elektrodu reverzibilního alkalického palivového článku na bázi nikl-kobalt selenidu
  EN: A catalyst for oxygen electrode of a reversible alkali fuel cell based on nickel-cobalt selenide
- **PUV 2024-42130CS:** Protonová membrána pro palivový článek
  EN: A proton-exchange membrane for fuel cell

Grant schemes

- Member of JU-Clean Hydrogen Partnership, Czech Science foundation, Czech Technological agency, Operational Funds of EU, Ministry of Interior of Czech Republic, Commercial research for companies etc.

Contact person
Ludmila Kučerová
skal@fst.zcu.cz

FACULTY OF MECHANICAL ENGINEERING
UNIVERSITY OF WEST BOHEMIA

REGIONAL TECHNOLOGICAL INSTITUTE

EN

CZ

University of West Bohemia

Západočeská univerzita v Plzni

Type of the organisation

Public university; Research institute

Organisation activity

17 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen production

Hydrogen distribution and storage

Hydrogen storage

Hydrogen carriers

Fuel cells and fuel cells materials

Safety: hydrogen sensing materials

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- K. Shaji, S. Haviar, P. Zeman, Š. Kos, R. Čerstvý, J. Čapek, *Controlled sputter deposition of oxide nanoparticles-based composite thin films, Surf. Coat. Technol. 477 (2024), 30325*
- N. Kumar, S. Haviar, P. Zeman, *Three-Layer PdO/CuWO4/CuO System for Hydrogen Gas Sensing with Reduced Humidity Interference, Nanomaterials 11 (2021) 3456*
- N. Kumar, S. Haviar, J. Rezek, P. Baroch, P. Zeman, *Tuning Stoichiometry and Structure of Pd-WO_{3-x} Thin Films for Hydrogen Gas Sensing by High-Power Impulse Magnetron Sputtering, Materials 13 (2020) 5101*
- J. Čapek, Š. Batková, M. Matas, Š. Kos, T. Kozák, S. Haviar, J. Houška, J. Schusser, J. Minár, F. Dvořák, and P. Zeman, *Bixbyite-Ta_2N_2O film prepared by HiPIMS and postdeposition annealing: Structure and properties*, J. Vac. Sci. Technol. A. 38 (2020) 033409
- R. S. Yadav, D. Kashyap, I. Pitussi, M.G. Gebru, H. Teller, A. Schechter*, H. Kornweitz, *Trimetallic Alloys as an Electrocatalyst for Fuel Cells: The Case of Methyl Formate on Pt3Pd3Sn2, ACS Applied Materials and Interfaces*, 16, 43, 58573, 2024

https://www.zcu.cz/en/index.html

- M. G. Gebru, Palaniappan Subramanian*, Petr Bělský, R. S. Yadav, I. Pitussi, S. Sasi, R. Medlín, J. Minar, P. Švec, H. Kornweitz, Alex Schechter*, *Chemical-Dealloying-Derived PtPdPb-Based Multimetallic Nanoparticles: Dimethyl Ether Electrocatalysis and Fuel Cell Application, ACS Applied Materials and Interfaces*, 15, 49, 56930, 2023
- M. G. Gebru, R. S. Yadav, H. Teller, H. Kornweitz, P. Subramanian*, A. Schechter*, *Harnessing dimethyl ether and methyl formate fuels for direct electrochemical energy conversion, Journal of Energy Chemistry*, 83, 454, 2023
- M.G. Gebru, H. Teller, P. Subramanian*, A Schechter*, *Nonthermal Plasma-Modified Carbon-Carrying Sn-Based Ternary Nanocatalyst for High-Performance Direct Dimethyl Ether Fuel Cells, Energy Technology*, 2200835, 2022
- D. Kashyap, H. Teller, P. Subramanian*, P. Bělský, M.G. Gebrua, I. Pitussi, R. S. Yadav, H. Kornweitz, A. Schechter*, *Sn-based Atokite Alloy Nanocatalyst for High-Power Dimethyl Ether Fueled Low-Temperature Polymer Electrolyte Fuel Cell, J. Power Sources*, 544, 21882, 2022
- W. Zhang, N. Han, J. Luo, X. Han, S. Feng, W. Guo, S. Xie, Z. Zhou, P. Subramanian*, K. Wan, J. Arbiol, C. Zhang, S. Liu, M. Xu, X. Zhang, J. Fransaer, *Critical Role of Phosphorus in Hollow Structures Cobalt-Based Phosphides as Bifunctional Catalysts for Water Splitting, Small*, 18, 2103561, 2022

Patents

- Regeneration of carbon-fueled anodes (invention disclosure under review)
- 2 Czech patents granted on new fuel cell system control software developed by NTC-UWB research team

Grant schemes

- FW03010323 Enhancement of Hydrogen Storage Properties of AlTiVCr Light Weight High Entropy Alloys (HEA) by Ti3C2 Mxene and Several Plastic Deformation (EHSAL). *EIG Concert Japan Call 2021 (project coordinator)*. 2022–2025
- TH82020002 Development and processing of advanced metal hydride composites with specific micro-structure properties for mobile hydrogen storage applications, *M-EraNet call 2022* (project coordinator). 2023–2026
- TH83020002, Identification of the effect of hydrogen as a function of structural condition in pipeline distribution infrastructure and storage tanks, *CET Partnership Call* 2022. 2023–2026
- TQ06000001 Clad pipes for safe and effective hydrogen transport and storage (CladPipe4H2), *CET Partnership Call 2023*. 2024-2027
- TM05000013 – Advanced Graphene Electrode Architecture for Proton Exchange Membrane Fuel Cell, *Technology Agency of Czech Republic (TA CR)* – 2023–2025
- Discerning Study of ammonia Oxidation Reaction on Atomically Modified Electrocatalytic Materials, *CZ-IL International Project Funding* – 2025–2028
- CZ.02.01.01/00/22_008/0004572, Quantum Materials for Sustainable Technologies, *Ministry of Education, Youth and Sports of Czech Republic, co-funded by the European Union* – 2023–2028

Contact persons
Lukáš Prokop; Karel Borovec; Jan Vereš
lukas.prokop@vsb.cz; karel.borovec@vsb.cz; jan.veres@vsb.cz

VSB TECHNICAL UNIVERSITY OF OSTRAVA

EN

VSB – Technical University of Ostrava, Centre for Energy and Environmental Technologies

CZ

Vysoká škola báňská – Technická univerzita Ostrava, Centrum energetických a environmentálních technologií

Type of the organisation

Public university; Research institute

Organisation activity

20 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen production

Hydrogen distribution and storage

- Hydrogen storage
- Hydrogen gas grid
- Refueling station
- Hydrogen carriers
- Other hydrogen distribution and storage

Hydrogen end-use

- Power and heat
- Mobility
- Industry
- Mobile devices
- Fuel cells and fuel cells materials
- Other hydrogen end-use

https://ceet.vsb.cz

Hydrogen service provision

Safety

Codes and standards

Others including cross-cutting research directions

We are a research and development centre with a broad technical background. We focus on solving the whole hydrogen problem. We cooperate with a number of other internal departments and external organisations.

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Moldrik, P.; Chesalkin, A.; Minarik, D. Infrared Thermography and Computer Simulation in Research of PEM Fuel Cells. In Proceedings of the 2019 20th International Scientific Conference on Electric Power Engineering (EPE); IEEE, May 2019; pp. 1–5
- Moldrik, P.; Minarik, D.; Chesalkin, A. Research of Hydrogen Fuel Cells Based on PEM Technology. In Proceedings of the Proceedings of the 10th International Scientific Symposium on Electrical Power Engineering, ELEKTROENERGETIKA 2019; 2019; pp. 448–452
- Slanina, Z.; Krupa, F.; Nemcik, J.; Minarik, D. Visualization of Hydrogen Fuell Cells Laboratory. In; 2019; pp. 359–368
- Artem Chesalkin; Moldrik, P.; Mišák, S.; Averina, J.M.; Menshikov, V. V. Thermography of (LaCe)Ni5 Metal Hydride Storage System during Reversible H2 Sorption and Subsequent Thermal Distribution in a Fuel Cell. *Theoretical Foundations of Chemical Engineering* **2021**, *55*, 198–205, doi:10.1134/S0040579521010048
- Chesalkin, A.; Kacor, P.; Moldrik, P. Heat Transfer Optimization of NEXA Ballard Low-Temperature PEMFC. *Energies (Basel)* **2021**, *14*, 2182, doi:10.3390/en14082182
- Hrdina, L.; Culík, M.; Petrov, J.; Misak, S.; Prokop, L. Technical and Economic Evaluation of Hydrogen Production Sources for Use in Transport. In Proceedings of the 2023 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON); IEEE, March 22 2023; pp. 284–289
- Sharma, J.P.; Kumar, R.; Ahmadi, M.H.; Najser, J.; Blazek, V.; Prokop, L.; Assel Akanovna, Z.; Sarsenbayev, Y. Thermodynamic Analysis on CSP Integrated Cerium Oxide (CeO2 – CeO1.72/1.83) Water Splitting Cycle for Hydrogen Production. *Int J Hydrogen Energy* **2024**, *53*, 1259–1268, doi:10.1016/j.ijhydene.2023.11.338
- Sharma, J.P.; Kumar, R.; Ahmadi, M.H.; Bekbolatova, Z.; Sarsenbayev, Y.; Najser, J.; Blazek, V.; Prokop, L. Numerical Analysis on Inlet Position and Orientation for Enhanced Thermal Performance of a Solar Thermochemical Reactor for Two-Step WS Cycle for Hydrogen Production. *J Therm Anal Calorim* **2024**, *149*, 8409–8429, doi:10.1007/s10973-024-13154-z
- Jayachandran, M.; Gatla, R.K.; Flah, A.; Milyani, A.H.; Milyani, H.M.; Blazek, V.; Prokop, L.; Kraiem, H. Challenges and Opportunities in Green Hydrogen Adoption for Decarbonizing Hard-to-Abate Industries: A Comprehensive Review. *IEEE Access* **2024**, *12*, 23363–23388, doi:10.1109/ACCESS.2024.3363869
- Gupta, A.; Kumar, R.; Sharma, J.P.; Ahmadi, M.H.; Najser, J.; Blazek, V.; Prokop, L. The Role of Catalyst in Hydrogen Production: A Critical Review. *J Therm Anal Calorim* **2024**, *149*, 14517–14534, doi:10.1007/s10973-024-13753-w
- Skřínský Jan; Koloničný Jan; Ochodek Tadeáš; Synthesis of Modelling and Simulation for Hydrogen Gas Release and Explosion, Application of Experimental and Numerical Methods in Fluid Mechanics and Energy, MATEC Web of Conferences, 2020, 2261–236X
- Vereš Ján; Ochodek Tadeáš; Koloničný Jan; Safety Aspects of Hydrogen Fuelling Stations, Chemical Engineering Transactions, 2283–9216, doi: 10.3303/CET2291009

Patents

- Accredited method: Determination of H2 purity; Sampling of H2 to determine its purity, 2024

Grant schemes

- TN02000007: NAHYC-m, National Hydrogen Mobility Center
- TK02010187: Research on the potential of hydrogen technologies for transformation of energy mix of Moravian-silesian region (MSK), low-carbon energy and development of low-emission mobility
- TK05020042: Development of a plasma torch for thermochemical conversion of input materials into a gas with a high hydrogen concentration
- CK04000248 – ESO: ESO – Vehicle of category N1 powered by hydrogen cells
- SP2020/111: Hydrogen fuel conversion processes and hydrogen technology safety research
- TK03030198: Research and development processes of coke oven gas conversion to hydrogen and alternative fuel
- MV-107265/OBVV-2022: Safety Concept of Hydrogen Technologies for Smart Cities and Regions
- TK05010075: Complex hydrogen safety and security in the Moravian-Silesian Region
- TQ06000002: Cost and resource efficient hydrogen storage at ambient temperature and maximum pressure of 3.5 MPa
- TS01030175: Sustainable Catalytic Synthesis of Atmospheric Carbon and Green Hydrogen to Light Alcohols

Contact person
Ing. Josef Bříoušek, Ph.D.
josef.brousek@tul.cz

EN

TUL – Technická univerzita v Liberci

CZ

TUL – Technical University of Liberec

Type of the organisation

Public university

Organisation activity

20 **How many people are currently involved in hydrogen research within your organisation?**

Expertise and main sectors of your hydrogen research

Hydrogen production

Hydrogen distribution and storage

Hydrogen storage

Hydrogen end-use

Mobility

Fuel cells and fuel cells materials

Your most important hydrogen research, development and innovation results including research grants in the last five years

Publications

- Nová, Iva; Jelínek, Milan; Solfronk, Pavel; Koreček, David a Sobotka, Jiří. Production of Non-Compact, Lightweight Zinc-Tin Alloy Materials for Possible Storage of Liquid Hydrogen. Online. Manufacturing Technology. 2024, 24. ISSN 12132489. https://doi.org/10.21062/mft.2024.013.
- Chilver-Stainer, J.; Elbarghthi, A.F.A.; Wen, C.; Tian, M. Power Output Optimisation via Arranging Gas Flow Channels for Low-Temperature Polymer Electrolyte Membrane Fuel Cell (PEMFC) for Hydrogen-Powered Vehicles. Energies 2023, 16, 3722. https://doi.org/10.3390/en16093722

https://www.tul.cz

Grant schemes

- CZ.02.01.01/00/22_012/0008109 Infrastructural environment of doctoral study programmes at TUL. Ministry of Education, Youth and Sports, co-funded by European Union, 2023–2026.
- TH83020003 HyLife – Microbial risks associated with hydrogen underground storage in Europe. Technology Agency of the Czech Republic (CETPartnersip, TAČR EPSILON Programme, 2023–2026.

Česká vodíková technologická platforma, z. s. (HYTEP)

Hlavní 130, Řež, 250 68 Husinec, Česká republika

www.hytep.cz/en

www.hydrogendays.cz

info@hytep.cz

HYTEP
CZECH HYDROGEN
TECHNOLOGY PLATFORM
SINCE 2007