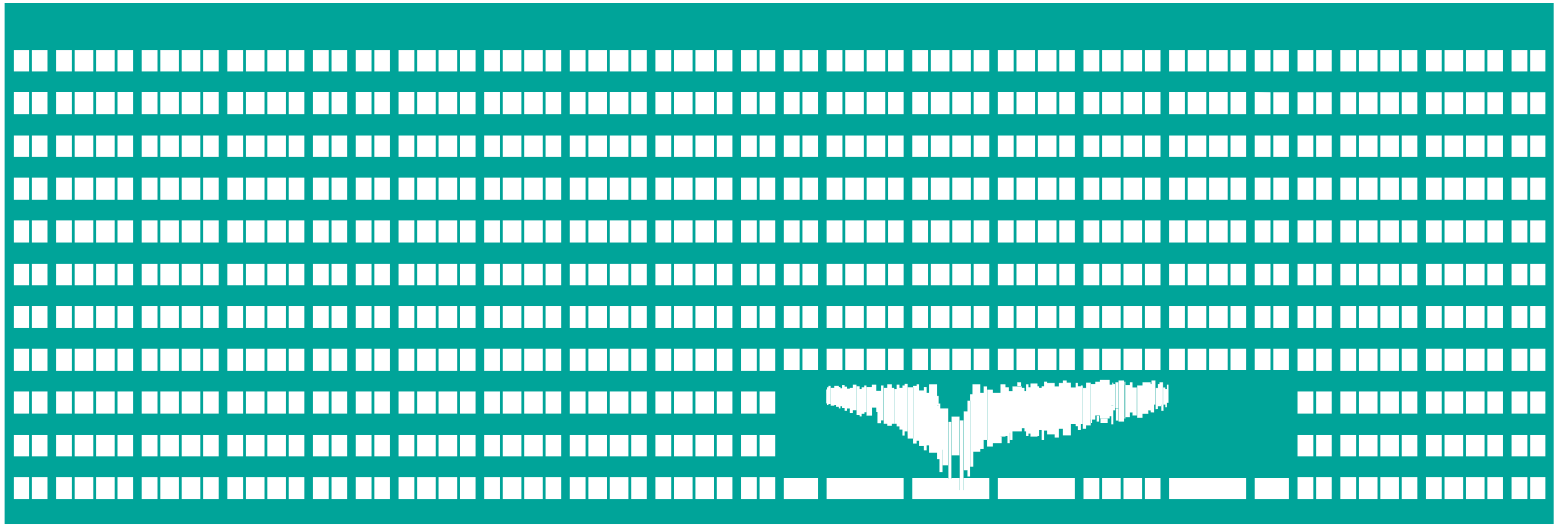
VŠB TECHNICKÁ UNIVERZITA OSTRAVA

VSB TECHNICAL UNIVERSITY OF OSTRAVA



www.vsb.cz

VSB TECHNICAL UNIVERSITY OF OSTRAVA

University Journal Club

Materials-Envi Lab

Radek Zbořil

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Who We Are

VSB TUO | CEET | NANOTECHNOLOGY CENTRE

ca 50 scientists from 12 countries
(Japan, Germany, Italy, India, Greece, Ukraine, Iran, Vietnam, China, Poland)

Teams composed of experts from prestigious institutions:
e.g. Max Planck Institute, Leibniz Institute, Karolinska Institutet, University of Tokyo, University of Trieste, University of Regensburg

- Over 700 publications; over **80 000 citations, h-index 132**
- **TO5 5 world scientists in water treatment** – Google Scholar
- **Highly Cited Researcher by Clarivate Analytics (US)** – TOP 1%
- The most cited CZ materials scientist 2022-2025 - research.com
- Czech Republic's Minister of Education Award (2011).
- the Werner von Siemens Award (2018)
- Visionary 2021 Award (2x) for Advanced Environmental Solutions
- the Czech Chemical Society Award (2023)
- **Member of European Research Council (ERC) Evaluation Panels** (2022-2025)
- Member of editorial boards of journals published by Nature fam., Wiley, Elsevier
- Prince Sultan Bin Abdulaziz **International Prize for Water** (PSIPW) - 2024

Scientific Director of Nanotechnology Centre, Centre for Energy and Environmental Technologies – CEET, VSB-TUO

Head of Materials-Envi Lab (established in 2021)

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Who We Are

Excellent Senior Researchers

Dr. A. Bakandritsos
H=47

4x PI/co-PI in Horizon Europe/Widera
PI of MERGE project at VSB-TUO
e.g. Nat. Nanotech..

Prof. Klaus Mullen
H=209
TOP 10 World Chemists
20 years Max-Planck Mainz Director
e.g. 10 Science and Nature papers

Assoc. Prof. Štěpán Kment
H=45

PI of Horizon Europe Project Sun4Fuel
e.g. Nature Catal.

Assoc. Prof. Jagadeesh Rajenahally
H= 35

Leibniz Institute for Catalysis
3x Science
10x Nature family

Dr. Yazhou Zhou
H=31

Moved from Max Planck Institute Mainz

Dr. Indrajit Ghosh
H=33

Moved from Uni Regensburg
2x Science, 2xNature

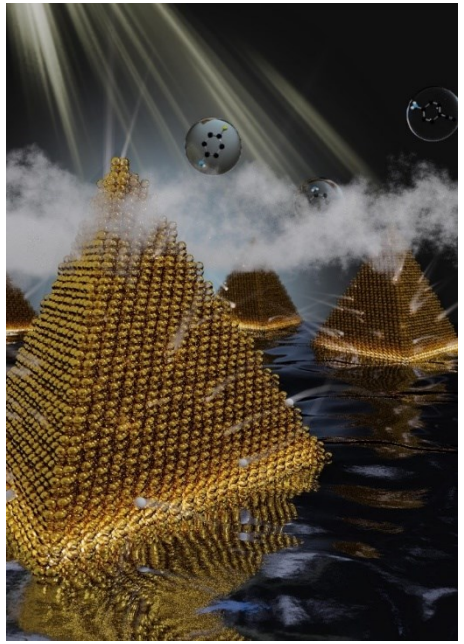
Excellent Junior Researchers

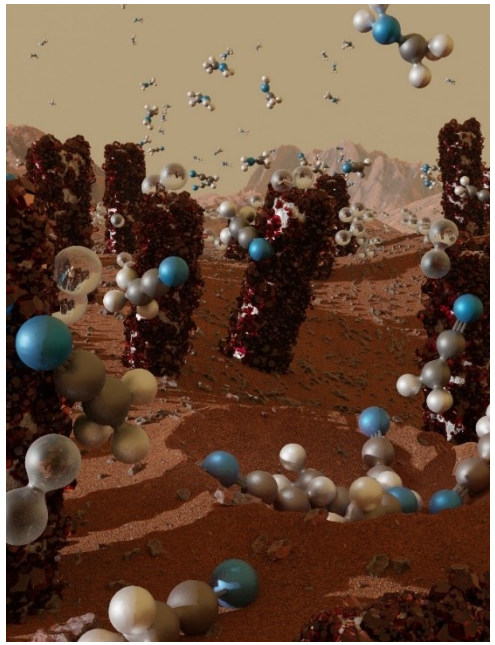
VSB TECHNICAL UNIVERSITY OF OSTRAVA

Research Focus – Chemistry/Catalysis

New Concepts in Organic Synthesis

- Substitution of expensive noble metals with $CuFeS_2$
- No need for high pressures and temperatures
- Superior TOF values for a broad scale of substrates = new way for production of anilines from nitro-compounds





Novel Heterogeneous Nanocatalysts

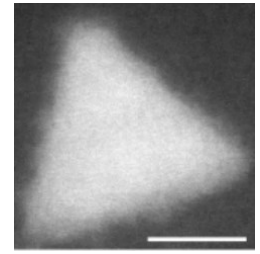
- The first heterogeneous iron-based catalyst for hydrogenation of nitro-compounds to amines
- Superior yields and selectivities compared to homogeneous catalysts; simple catalyst recovery

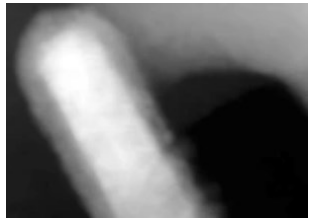
nature nanotechnology
ARTICLES
https://doi.org/10.1038/s41565-022-01087-3
Check for updates
OPEN

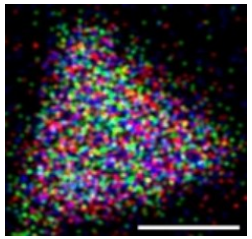
Fast and selective reduction of nitroarenes under visible light with an earth-abundant plasmonic photocatalyst

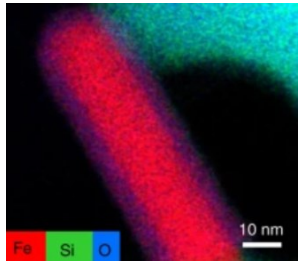
Aby Cheruvathoor Poulose[1✉], Giorgio Zoppellaro[1], Ioannis Konidakis[2], Efthymis Serpetzoglou[2], Emmanuel Stratakis[2], Ondřej Tomanec[1], Matthias Beller[3], Aristides Bakandritsos[1,4✉] and Radek Zbořil[1,4✉]

Nature Nanotechnology, 17, 485, 2022.









ARTICLES
https://doi.org/10.1038/s41929-021-00722-x
nature catalysis
Check for updates
OPEN

Silica-supported Fe/Fe–O nanoparticles for the catalytic hydrogenation of nitriles to amines in the presence of aluminium additives

Vishwas G. Chandrashekhar[1], Thirusangumurugan Senthamarai[1], Ravishankar G. Kadam[2], Ondřej Malina[2], Josef Kašlík[2], Radek Zbořil[2,3✉], Manoj B. Gawande[2,4✉], Rajenahally V. Jagadeesh[1✉] and Matthias Beller[1✉]

Nature Catalysis 5, 20, 2022.

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Research Focus – Energy Harvesting/Storage

PHOTO/ELECTRO-CATALYTIC HYDROGEN PRODUCTION

Nano-Micro Letters

e-ISSN 2150-5551
CN 31-2103/TB

REVIEW https://doi.org/10.1007/s40820-024-01505-2

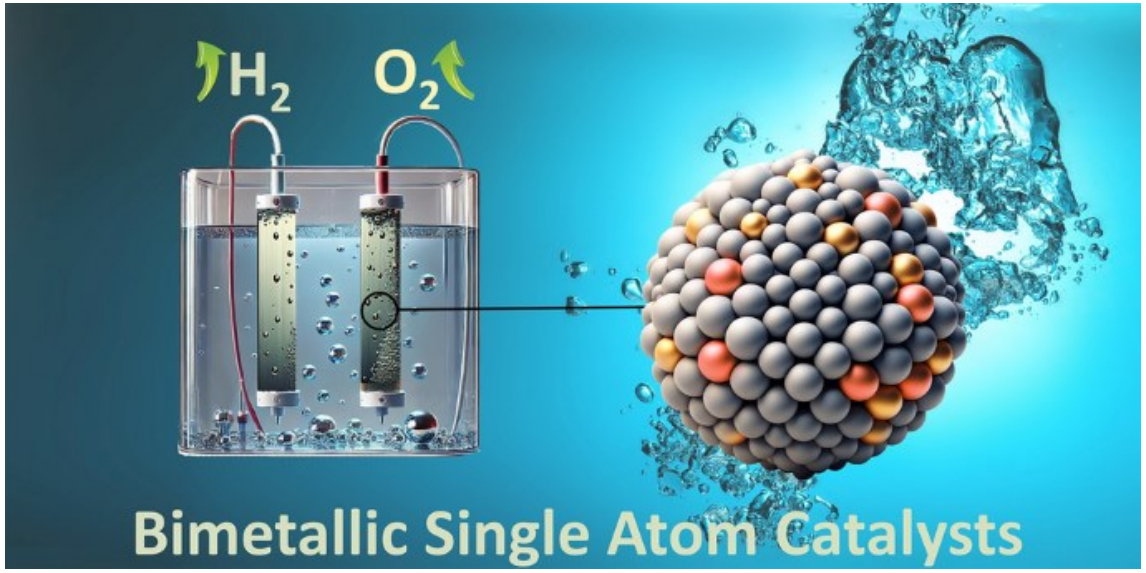
Check for updates

Cite as
Nano-Micro Lett.
(2025) 17:1

Bimetallic Single-Atom Catalysts for Water Splitting

Megha A. Deshmukh[1], Aristides Bakandritsos[1,2] ✉, Radek Zbořil[1,2] ✉

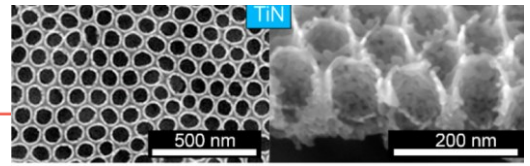
NANO-MICRO LETTERS, vol. 17, article no. 1, 2025.



PLASMONICS

NANO LETTERS
pubs.acs.org/NanoLett

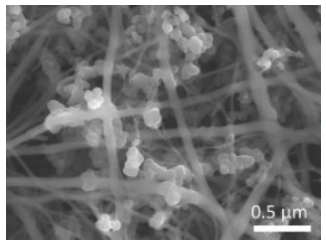
Nano Letters 20 (2020) 3663.

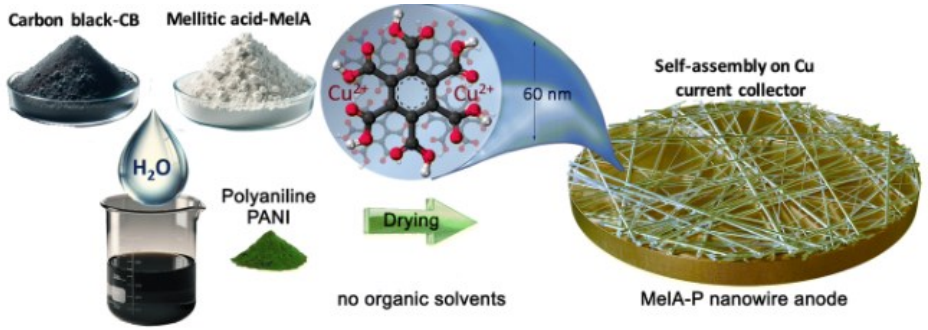


Solar Thermoplasmonic Nanofurnace for High-Temperature Heterogeneous Catalysis

Alberto Naldoni,* Zhaxylyk A. Kudyshev, Luca Mascaretti, Smritakshi P. Sarmah, Sourav Rej, Jens P. Froning, Ondřej Tomanec, Jeong Eun Yoo, Di Wang, Štěpán Kment, Tiziano Montini, Paolo Fornasiero, Vladimir M. Shalaev, Patrik Schmuki, Alexandra Boltasseva,* and Radek Zbořil*

BEYOND Li-BATTERIES





Energy & Environmental Science

PAPER View Article Online
View Journal | View Issue

Check for updates

Cite this: *Energy Environ. Sci.*, 2024, 17, 8874

Harnessing enhanced lithium-ion storage in self-assembled organic nanowires for batteries and metal-ion supercapacitors†

Ievgen Obraztsov, [a]* Rostislav Langer,[b] Jean G. A. Ruthes, [de] Volker Presser, [def] Michal Otyepka, [ab] Radek Zbořil [ac]* and Aristides Bakandritsos [ac]*

EES 17 (2024) 8874

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Research Focus – Biomedicine

CATALYTIC MEDICINE

nature nanotechnology

Nat. Nanotech. 20 (2025) 554.

Article

https://doi.org/10.1038/s41565-025-01870-y

Intracellular dehydrogenation catalysis leads to reductive stress and immunosuppression

Received: 4 December 2023

Accepted: 17 January 2025

Published online: 20 February 2025

Jie Jiang[1,6], Huizhen Zheng[1,6], Zhenzhen Wang[2], Xinlian Wang[2], Qianqian Xie[1], Xi Liu[1], Qing Yang[3], Xiaoming Cai[3], Xingfa Gao[2], Ruibin Li[1,4] ✉ & Chunying Chen[2,5] ✉

EcoMat Open Access

FUNCTIONAL MATERIALS FOR GREEN ENERGY AND ENVIRONMENT

EcoMat. 7 (2025) e70009.

RESEARCH ARTICLE | Open Access

Light Irradiation of N-Doped Graphene Acid: Metal-Free Strategy Toward Antibacterial and Antiviral Coatings With Dual Modes of Action

Giacomo Reina, David Panáček, Krista Rathammer, Stefanie Altenried, Philipp Meier, Paula Navascués, Zdeněk Baďura, Paula Bürgisser, Vera Kissling, Qun Ren, Radek Zbořil ✉, Peter Wick ✉

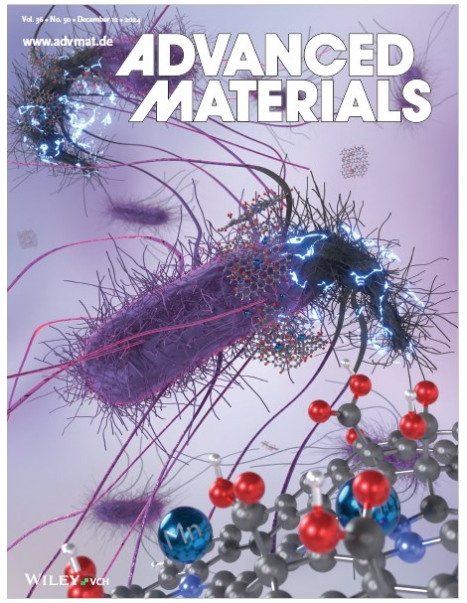
NEW ANTIMICROBIAL TECHNOLOGIES

RESEARCH ARTICLE

ADVANCED MATERIALS www.advmat.de

Single Atom Engineered Antibiotics Overcome Bacterial Resistance

David Panáček, Jan Belza, Lucie Hochvaldová, Zdeněk Baďura, Giorgio Zoppellaro, Martin Šrejber, Tomáš Malina, Veronika Šedajová, Markéta Paloncýová, Rostislav Langer, Lukáš Zdražil, Jianrong Zeng, Lina Li, En Zhao, Zupeng Chen, Zhiqiang Xiong, Ruibin Li, Aleš Panáček, Renata Večeřová, Pavla Kučová, Milan Kolář, Michal Otyepka, Aristides Bakandritsos, and Radek Zbořil**



Adv. Sci. 8 (2021) 2003090. *Adv. Mater. 36 (2024) 2410652.*

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Research Focus – Biomedicine

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Research Focus – Environmental Technologies

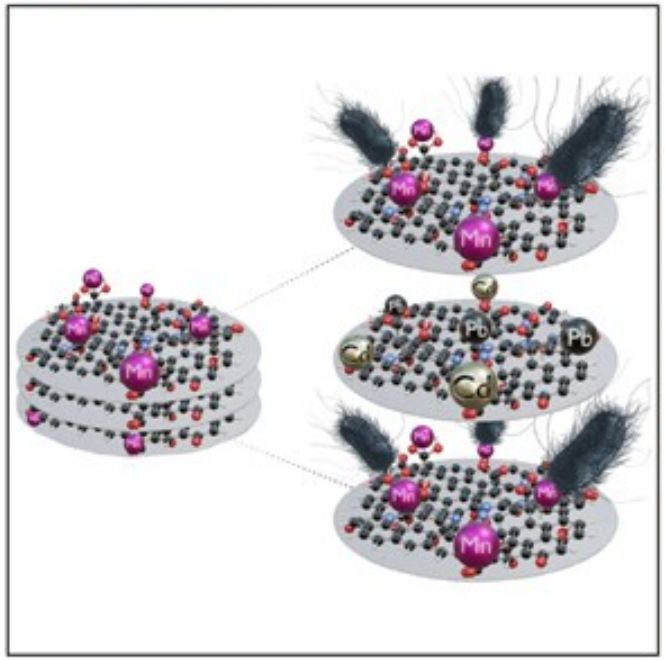
Water Treatment

Chem

Article

Single-atom-enhanced membrane for simultaneous bacteria and heavy metal on-site water treatment

Graphical abstract



Authors

David Panáček, Renata Večeřová, Zdeněk Bařdura, ..., Aleš Panáček, Aristides Bakandritsos, Radek Zbořil

Correspondence

david.panacek@upol.cz (D.P.), a.bakandritsos@upol.cz (A.B.), radek.zboril@upol.cz (R.Z.)

In brief

Clean water access remains a global challenge, especially in resource-limited areas. Panáček et al. present a graphene-based filtration membrane engineered with single-atom manganese that simultaneously removes bacteria and heavy metals in one step. The system requires only a hand-powered vacuum, achieves outstanding filtration efficiency across diverse water sources, and maintains reusability for many cycles. This portable, sustainable approach highlights how advanced nanomaterials can be translated into simple and impactful water purification technologies.

Highlights

- A portable graphene-based membrane removes bacteria and heavy metals in one step

Chem (2025), https://doi.org/10.1016/j.chempr.2025.102785

Waste Valorisation

nature communications

Article

https://doi.org/10.1038/s41467-023-36602-0

Acidic graphene organocatalyst for the superior transformation of wastes into high-added-value chemicals

Received: 7 August 2022

Accepted: 7 February 2023

Published online: 13 March 2023

Aby Cheruvathoor Poulose[1], Miroslav Medved'[1,2], Vasudeva Rao Bakuru[3], Akashdeep Sharma[4], Deepika Singh[5], Suresh Babu Kalidindi[6], Hugo Bares[1,9], Michal Otyepka[1,7], Kolleboyina Jayaramulu[4] ✉, Aristides Bakandritsos[1,8] ✉ & Radek Zbořil[1,8] ✉

Nature Comm. 14 (2023) 1373.

nature communications

Article

https://doi.org/10.1038/s41467-025-58559-y

Synthesis of aromatic amides from lignin and its derivatives

Received: 7 August 2024

Accepted: 24 March 2025

Published online: 11 April 2025

Zhuang Ma[1], Zupeng Chen[2], Zeli Yuan[3], Changyue Ren[1,3], Binyu Zhang[4], Yanbin Cui[4], Xinmin Li[1,3] ✉, Rajenahally V. Jagadeesh[1,5,6] ✉ & Matthias Beller[1] ✉

Nature Comm. 16 (2025) 3476.

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Key Results

Over 90 publications/year
ca 2/3 (60 papers) in D1

e.g. Chemical Reviews (IF=72.0),
Chemical Society Reviews (60.6),
Nature Catalysis (41.8),
Nature Nanotechnology (34.9),
Advanced Materials (26.8),
Energy Environ. Sci (38.5),
Nano-Micro Letters (36.3),
Advanced Energy Materials (26.0)

Zlikvidují i ty nejodolnější bakterie. Čeští vědci vyvinuli revoluční antibiotika

iDNES.cz

3. října 2024 10:41

Unikátní cestu pro vývoj antibiotik nové generace, která jsou účinná vůči širokému spektru bakterií a dokážou bránit i rozvoji bakteriální rezistence, objevili vědci z Univerzity Palackého v Olomouci a Vysoké školy báňské – Technické univerzity Ostrava ve spolupráci s kolegy z Číny. Nový materiál má obrovský potenciál zejména v lokální terapii, například při hojení ran.

Čeští vědci vyrábějí chemikálie a průmyslové produkty z minerálů a slunce

Filip Šára, Novinky
vybrat autory ke sledování

Novinky.cz

13. 4. 2022, 18:00

Průlom v boji s energetickou krizí, a to v podobě slunce místo elektrických pecí nebo levného nanomateriálu namísto zlata? Takto lze zjednodušeně popsat nový postup, který dokáže urychlit a zlevnit výrobu léčiv, chemikálií, plastů či barviv. Základem technologie vyznačující se významným snížením energetických nákladů je nanomateriál vyvinutý českými vědci ve spolupráci se zahraničními kolegy.

Stačí posvítit. Nový materiál likviduje bakterie i viry

Miloslav Hradil
+ sledovat 291

3:07 Chcete-li článek poslouchat, přihlaste se

Novinky.cz

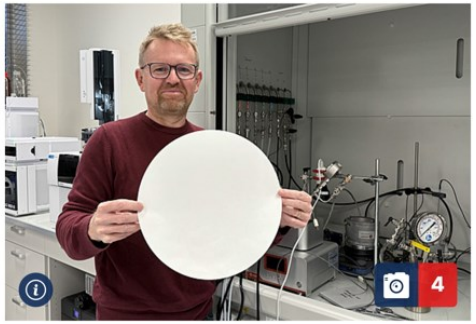
2. 6. 2025, 6:28 • Olomouc

Usmrtit bakterie pomocí světla, právě tak jednoduchá by v budoucnu mohla být dezinfekce povrchů. Vědci z Česka a ze Švýcarska se již pustili do vývoje speciálního povlaku, jehož antimikrobiální účinek lze aktivovat infračerveným světlem. První praktické využití nového materiálu se aktuálně připravuje ve stomatologii.

iDNES.cz

Odstraní z vody bakterie i těžké kovy. Čeští vědci vyvinuli revoluční membránu

Autor: ČTK, iDNES.cz
21. listopadu 2025 13:48



Superkondenzátor překonává komerční materiály pro ukládání energie

Průmyslová ekologie.cz

27. 5. 2025 | zdroj: vedaavyzkum.cz

Vědci z Centra energetických a environmentálních technologií a IT4Innovations na VŠB – Technické univerzitě Ostrava ve spolupráci s kolegy z CATRIN Univerzity Palackého v Olomouci představili průlomovou technologii, která propojuje čištění vody a ukládání energie v duchu cirkulární ekonomiky.

Pomocí funkcionalizovaného grafenu se jim podařilo účinně odstranit farmaceutické znečišťující látky z vody a následně přímo – bez jakékoli další úpravy – přeměnit použité sorbenty na elektrody pro tzv. superkondenzátory. Tyto elektrody překonaly výkonnost původních materiálů až o 100 procent a jsou velmi slibné pro využití v moderních technologiích ukládání energie. Výsledky jejich práce publikoval prestižní časopis Journal of Colloid and Interface Science.

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Current Projects

Examples of Horizon Europe Projects

VSB TECHNICAL UNIVERSITY OF OSTRAVA | CENTRE FOR ENERGY AND ENVIRONMENTAL TECHNOLOGIES

GlaS - Fuels

Single-Atom Photocatalysts Enhanced by a Self-Powered Photonic Glass Reactor for Advanced Biofuels

2024-2026
Total 3 mil. EUR

UNIVERSITY OF TRIESTE | Leibniz-Institut für Polymerforschung Dresden | FORTH INSTITUTE OF ELECTRONIC STRUCTURE AND LASER | VSB TECHNICAL UNIVERSITY OF OSTRAVA

Dr. Bakandritsos

MERGE GREEN CHEM

Twinning Excellence in Management and Research for Green Energy and Chemicals Using Single-atom Catalysis

2024-2027
Total 1.5 mil. EUR

core | POLITECNICO MILANO 1863 | university of groningen | Q-PLAN INTERNATIONAL | VSB TECHNICAL UNIVERSITY OF OSTRAVA

Prof. Zbořil

SAN4Fuel

Single Atom Based Nanohybrid Photocatalysts for Green Fuels

2022-2025
Total 1.5 mil. EUR

FAU FRIEDRICH-ALEXANDER UNIVERSITÄT ERLANGEN-NÜRNBERG | UNIVERSITY OF TRIESTE | Univerzita Palackého v Olomouci | VSB TECHNICAL UNIVERSITY OF OSTRAVA

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Collaborations

Collaborations with ca 30 top institutions and universities across the world, e.g.:

- **University of Oxford (1st in THE ranking; 3rd in QS ranking)**
  - **Imperial College of London, UK (2nd in QS ranking)**
  - **California Institute of Technology, USA (7th in THE)**
- **Technical University of Munich, Germany (26th in THE)**
  - **Karolinska Institute, Sweden (49th in THE)**

Technical University of Munich

Chemical Reviews > Vol 122/Issue 24 > Article

Open Access

REVIEW | November 1, 2022

Graphene-Based Metal–Organic Framework Hybrids for Applications in Catalysis, Environmental, and Energy Technologies

Kolleboyina Jayaramulu*, Soumya Mukherjee, Dulce M. Morales, Deepak P. Dubal, Ashok Kumar Nanjundan, Andreas Schneemann, Justus Masa, Stepan Kment, Wolfgang Schuhmann, Michal Otyepka, Radek Zbořil*, and Roland A. Fischer*

Angewandte Chemie — GDCh Eine Zeitschrift der Gesellschaft Deutscher Chemiker

Forschungsartikel | Open Access

Verbesserter Stofftransport und Ladungstransfer in COF-basierten Photokatalysatoren mit dreidimensional geordneten Makroporen für die Benzylaminoxidation und Wasserstoffentwicklung

Lijuan Sun, Prof. Weicheng Yan, Dr. Weikang Wang, Dr. LeLe Wang, Prof. Silvio Osella, Prof. Guijie Liang, Prof. William A. Goddard III, Prof. Radek Zbořil ... See all authors

First published: 09 June 2025 | https://doi.org/10.1002/ange.202511080

Karolinska Institutet

ACS NANO

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www.acsnano.org

Nanodiamonds Interact with Primary Human Macrophages and Dendritic Cells Evoking a Vigorous Interferon Response

Tomas Malina, Jasreen Kaur, Sebastin Martin, Audrey Gallud, Shintaro Katayama, Arianna Gazzi, Marco Orecchioni, Martin Petr, Martin Šrejber, Lars Haag, Bejan Hamawandi, Muhammet S. Toprak, Juha Kere, Lucia Gemma Delogu, and Bengt Fadeel*

ARTICLE

Caltech

ACS NANO

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www.acsnano.org

Covalent-Bridged Heterointerfaces via Grafted Triazine Organic Polymers Enable Directed Charge Transfer for Efficient Oxygen Reduction in Zn–Air Batteries

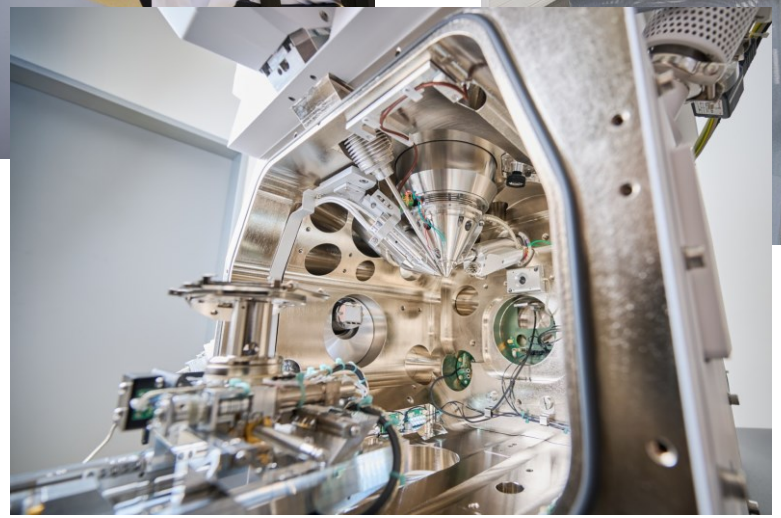
Shan Chen, Jitao Shang, Fei-er Peng, Zihan Song, Yong Zheng,* Yuhang Dai, Jiexin Zhu, Fei Guo, Xinliang Fu, Kaibin Chu, Xueying Cao,* Yue Ouyang,* Ivan P. Parkin, Yazhou Zhou,* Guanjie He, Tianxi Liu, and Wei Zong*

UNIVERSITY OF OXFORD — DOMINVS ILLVMINATIO MEA

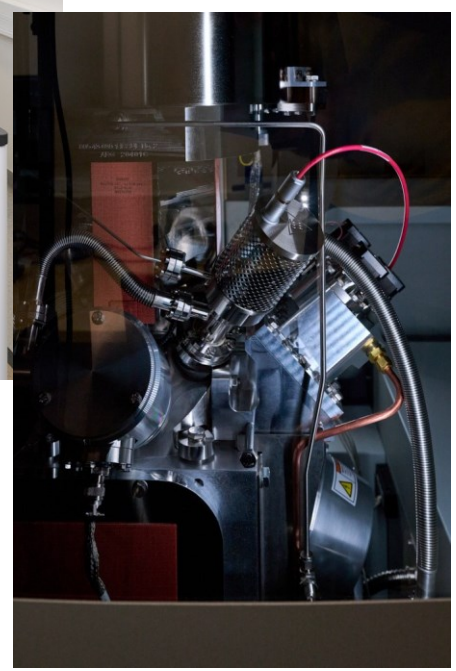
VSB TECHNICAL UNIVERSITY OF OSTRAVA

What We Seek / Offer

The most powerful microscopic lab for analysis of materials with atomic scale precision



Scanning Electron Microscope with Focused Ion Beam (SEM/FIB)

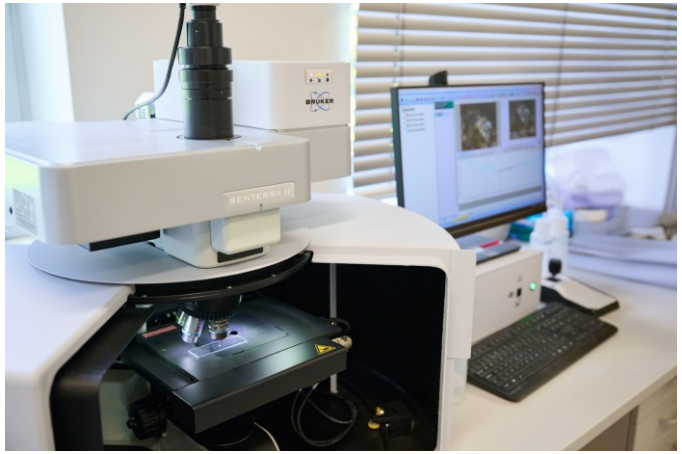


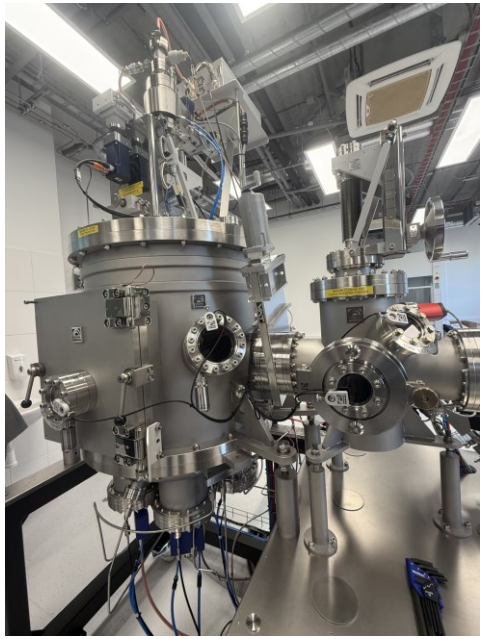
High Resolution Scanning Electron Microscope combined with X-ray Photoelectron Spectroscopy (HRSEM/XPS)

VSB TECHNICAL UNIVERSITY OF OSTRAVA

What We Seek / Offer

Cutting-edge labs with synthetic and spectroscopic techniques for atomic scale engineering





VSB TECHNICAL UNIVERSITY OF OSTRAVA

What We Seek / Offer

We offer:

- ❑ Utilization of state-of-the-art infrastructure
- ❑ Tailored development of materials with exceptional optical, sensing, chemical, magnetic properties
- ❑ Development/optimization of various technologies in chemistry, energy, water treatment, sensorics, medicine
- ❑ Know-how sharing - joint project applications

We seek for:

- ❑ Materials testing in real-scale technologies
- ❑ Shift to higher TRL
  - proof-of-concept technologies
- ❑ Involvement of students in development, characterization and applications of advanced materials
- ❑ AI-design and computational modelling of materials, their properties and mechanisms of action

VSB TECHNICAL UNIVERSITY OF OSTRAVA

Thank you for your attention

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