ALEXANDER KROMKA, prof., Ing., Ph.D., DrSc.

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PROFESSIONAL INTERESTS / RESEARCH EXPERTISE

PVD and CVD deposition, thin films, diamond CVD, microwave plasma and HF CVD processes, diamond doping, optical centers in diamond, material structuring by reactive ion etching, diamond-based electronic and optical devices, biosensors, seeding and nucleation techniques, polymer composites, surface modifications and functionalization of diamond, material characterization (Raman/PL, SEM, XRD). Nanomaterials and nanotechnologies. Plasma physics. Biosensors and MEMS. Wide bandgap semiconductors.

EDUCATION

2022 Professor
Habilitation in the field of applied physics, Faculty of Electrical Engineering, Czech Technical University, Prague, Czech Republic.

2017 Assoc. prof.
Habilitation (associated professor) in the field of applied physics, Faculty of Electrical Engineering, Czech Technical University, Prague, Czech Republic.

2016 DrSc. degree
Habilitation in program 020205 – Electrotechnology and materials, Slovak Academy of Sciences, Bratislava, Slovakia. Thesis: Novel trends in diamond thin film technologies for fundamental and applied research.

2001 Ph.D. degree
Faculty of Electrical Engineering and Information Technology, Slovak Technical University, Bratislava, Slovakia. PhD. Thesis: Growth of Diamond Thin Films by a Hybrid Hot Filament CVD Technique. Supervisor: Dr. Stefan Bederka.

1995 MSEE degree
Faculty of Electrical Engineering and Information Technology, Slovak Technical University, Bratislava, Slovak Republic, MSEE Thesis: Deposition and Properties of AlN and SiC Films, Supervisor: Dr. Dalibor Buc

PROFESIONAL EXPERIENCE

2022-now Deputy head
Department of Semiconductors, Institute of Physics, Czech Academy of Sciences, Prague, Czech Republic.

2013-now Group leader
Institute of Physics, Czech Academy of Sciences, Prague, Czech Republic

2019 Visiting research scientist
group of Prof. Ulrich Schmid - ISAS TU Wien, Technical University Wien, Austria. *MEMS devices based on diamond and AlN thin films CVD* (6 months).

2008 Visiting research scientist
group of Prof. Dr. Ken Haenen – WBGM, Institute for Materials Research, Hasselt, Belgium. *Diamond growth by microwave plasma CVD* (3 months).

2006-2008 Researcher
group Dr. Milan Vanecek, Institute of Physcis, Czech republic.
Diamond Research on Interfaces for Versatile Electronics (DRIVE).

2003-2005 Researcher
group Dr. Doris Steinmuller-Nethl - rho-best coating plc., Innsbruck, Austria.
Large area growth of nano-crystalline diamond by modified HF CVD process.

2001-2002 Postdoctoral training
group Prof. Dr. Erhard Kohn - EBS Institute of Electron Devices and Circuits, Ulm, Germany. *3-Dimensional multi-chip modules*.

1989-1999 Technician
group of Prof. Leo W.M. Lau - Department of Physics, Chinese University of Hong Kong. *Design and development of vacuum chamber for advanced ion beam and laser technologies.*

PUBLICATION ACTIVITIES

***h*-index of 32 Scopus**, as of September 2023

Authored 8 book chapters, > 300 peer reviewed journal papers which received >5213 citations, 6 patents, 8 utility models (CZ) and 2 industrial procedures (CZ)

Selected 5 most important papers since 2018:

1 M. Kočí, T. Izsák, G. Vanko, M. Sojková, J. Hrdá, O. Szabó, M. Husák, K. Végsö, M. Varga, A. Kromka: Improved gas sensing capabilities of MoS2/H-NCD heterostructures at room temperature, ACS Appl. Mater. Interfaces 15 (28) (2023) 34206–34214 (doi: 10.1021/acsami.3c04438), cited: 0x.

2 M. Marton, M. Vojs, P. Michniak, M. Behúl, V. Rehacek, M. Pifko; Š. Stehlík, A. Kromka: New chemical pathway for large-area deposition of doped diamond films by linear antenna microwave plasma chemical vapor deposition, Diamond & Related Materials 126 (2022) 109111, (doi: 10.1016/j.diamond.2022.109111), cited 6x.

3 S. Stehlik, M. Mermoux, B. Schummer, O. Vanek, K. Kolarova, P. Stenclova, A. Vlk, M. Ledinsky, R. Pfeifer, O. Romanyuk, I. Gordeev, F. Roussel-Dherbey, Z. Nemeckova, J. Henych, P. Bezdicka, A. Kromka, B. Rezek: Size effects on surface chemistry and Raman spectra of sub-5 nm oxidized HPHT and detonation nanodiamonds, The Journal of Physical Chemistry C 125 (10) (2021) 5647–5669 (doi: 10.1021/acs.jpcc.0c09190), cited 16x.

4 S. Tulić, T. Waitz, M. Čaplovičová, G. Habler, M. Varga, M. Kotlár, V. Vretenár, O. Romanyuk, A. Kromka, B. Rezek, V. Skákalová: Covalent Diamond–Graphite Bonding: Mechanism of Catalytic Transformation, ACS Nano 13 (2019), 4621-4630 (doi: 10.1021/acsnano.9b00692), cited 21x.

5 V. Rehacek, I. Hotovy, M. Marton, M. Mikolasek, P. Michniak, A. Vincze, A. Kromka, M. Vojs: Voltammetric characterization of boron-doped diamond electrodes for electroanalytical applications, Journal of Electroanalytical Chemistry 114020 (2020) (doi: 10.1016/j.jelechem.2020.114020), cited 21x

APPLICATION RESULTS

1 EU patent applications pending No. EP21218421.2 (30.12.2021): A method for growing boron doped diamond and product thereof.
M. Marton, M. Vojs, M. Behul, V. Rehacek, A. Kromka, Š. Stehlík

2 EU patent applications pending No. EP21196739.3 (15.09.2021): Nanoporous diamond structure, method of production thereof, a battery and a sensor comprising thereof.
A. Kromka, Š. Stehlík, R. Pfeiffer, O. Szabo, Š. Potocky, M. Marton, M. Vojs

3 EU Patent No. EP2257658 (26.8.2015 EU patent granted): Method of making nucleation layer for diamond growth
B. Rezek, M.Vaněček, A. Kromka, Š.Potocký, J.Potměšil
4 CZ Patent No. 307606 (PV2008-103, 28.11.2018): Method of making electrostatically charged patterns.
B. Rezek, J. Čermák, A. Kromka
5 CZ Patent No. 305482 (9.9.2015): Hybridní plazmová tryska s povrchovou vlnou pro buzení vysoce reaktivních výbojů
Z. Hubička, V. Straňák, J. Šmíd, J. Olejníček, M. Čada, P. Adámek, Š. Kment, A. Kromka

RESEARCH GRANTS

Since 2016 acquired more than 1.553 million Euro on international research grants and contract research projects:

2023-2025 Czech Science Foundation of the Czech Republic
22-04322L, Lead Agency bilateral CZ-PL, applicant
224 000 euro FZU
Heterogenous diamond biosensing nanoarchitectures: opto-electro-chemical interactions with antibody complexes

2022-2025 Ministry of Education, Youth and Sports of the Czech Republic
INTER-ACTION-LUASK22 CZ-SK, applicant
120 000 euro FZU
Growth and Radiation Mechanisms in Diamond Hybrid Detector

2019-2023 Technology Agency of the Czech Republic
TK02020094, co-applicant
1 291 000 euro (268 000 euro FZU)
3D printed diamond composite components for more efficient energetics

2021-2022 Ministry of Health, Czech Republic
AZV 15-33018A, co-applicant
811 000 euro (161 000 euro FZU)
Application of adipose tissue-derived stem cells obtained by liposuction in tissue engineering

2012-2018 Czech Science Foundation of the Czech Republic
P108/12/G108 Centre of excellence CSF, co-applicant
3 782 000 eur (905 000 euro FZU)
Preparation, modification and characterization of materials by radiation

INVITED TALKS AT INTERNATIONAL CONFERENCES (last 5 years)

Regular seminars at universities and research institutions and invited talks at international conferences (in total 30+):

1 invited talk - Diamond interfaces for gas and bio sensors, Erwin Schrödinger Society for Nanosciences, ESG conference, 9 – 11 October 2023, Dornbirn, Austria.
2 invited talk - Nanostructured Diamond Coatings with Unique Functions for Biomedical Engineering, 4th International Conference on Nanomaterials - Research & Application, NANOCON 2022, 19 – 21 October 2022, Brno, Czech Republic
3 keynote speaker - Diamond nanostructures for (bio-) sensor applications, Inter. Webinar on Frontiers in Materials for Technological Applications, CSIR Institute of Minerals and Materials Technology, 3-7 August, 2020, Bhubaneswar, India.

4 invited talk - Diamond thin film technologies: nucleation & growth, KIST-CAS-CEITEC Joint Workshop for Nanotechnology and Nanoscience, 3. - 6. 12. 2017, Soul, Korea.
5 invited talk - Growth of Diamond Thin Films with Enhanced Functions for (bio)-Sensoric and Life Sciences, 1st German Czechoslovak Conference on Crystal Growth GCCCG-1 / DKT2016:, 16-18 March, 2016 Dresden, Germany.

AWARDS and FELLOWSHIPS

2015 diploma from Hungarian Academy of Science for the skilled leading of the student Maria Domonkos.
2014 1st place in poster session at international conference NANOCON 2014 with the contribution „Fabrication of 3D diamond membranes for microfluidic systems„ (Brno, Czech Republic) (http://www.nanocon.eu/cz/).
2009 Fellowship Jana Evangelisty Purkyně, Czech Academy of Sciences.
2001 Werner von Siemens Excellence Award for Ph.D. Thesis

TEACHING ACTIVITIES AND SUPERVISION OF STUDENTS

Teaching

since 2019 Biosensors (30%), supervised by Prof. B. Rezek, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic.
2013-2021 Nanotechnology (30%), program D62ZNT supervised by prof. RNDr. Pavel Demo, Faculty of Civil Engineering, Czech Technical University in Prague, Czech Republic.

contribution with a lesson(s) as an external specialist in the following courses:

since 2020 Special topics in nanoscience, FC510, MUNI Brno, supervised by Assoc. prof. Jozef Ráheľ
since 2012 Progressive physical technologies (FAV, ZCU Plzen, supervised by Prof. P. Baroch).
since 2007 Chapters from nanoelectronics (TU Liberec, supervised by Prof. E. Hulicius)

Supervision of students: (see https://www.fzu.cz/~kromka/academic_activities.htm)

Ph.D. 6x sucesfully finished students: Tibor Ižák, Marina Davydova, Marián Varga, Oleg Babchenko, Mária Domonkos, Vašek Procházka
2x students continiing study: Jakub Budil (2018) and Michal Kočil (2020)
Master 2 students since 2016 (in total 6 students)

COMMISSIONS OF TRUST AND SERVING SCIENTIFIC COMMUNITY

Memberships

2019-2024 Member of Board of Doctoral Degree Program - Electronic P2612V015 FEE Czech Technical University in Prague, Czech Republic
2019-2024 Member of Board of Doctoral Degree Program – Applied Physics FEE Czech Technical University in Prague, Czech Republic
2017-2019 Member of Board of Doctoral Degree Program - Electronic and Informatics P2612, FEE Czech Technical University in Prague, Czech Republic
2013-2017 Member of Board of Doctoral Degree Program - Electronic and Informatics P2612, FEE Czech Technical University in Prague, Czech Republic
since 2015 Member of board for state exams of Ph.D. students, Faculty of Civil Engineering, Czech Technical University in Prague, Czech Republic

Committee membership of conferences:

2022 ASDAM ‘22 - 14th International Conference on Advanced Semiconductor Devices And Microsystems, 23-26. October, 2022, Smolenice, Slovakia. http://uef.fei.stuba.sk/asdam/commitee.php

2018 Member of Program Committees - 4th Annual International Workshop on Materials Science and Engineering – IWMSE 2018, May 18-20, 2018, Xi'an, China

2008-2018 Member of Organisational Committee of the Hasselt Diamond Workshop – Surface and Bulk Defects in Diamond (SBDD), time period 2008-2018

2018 Member of International Advisory Board - CIMTEC 2018 - 14th International Conference on Modern Materials and Technologies, section FN - 6th International Conference Novel Functional Carbon Nanomaterials, Perugia, Italy, June 4 to14, 2018

2017 Member of Scientific committee, E-MRS Spring, 2017, NANOMATERIALS: section Q) Nano-engineering coatings and thin films, 2017.

Referee and reviewer

2020 - now Member of the Editorial Board of the *nanomaterials* journal.

- Evaluator of international projects for agencies: APVV (Slovakia, since 2010), Vega (Slovakia, since 2014), GAUK (Czech Republic, since 2014), DFG – ELAN (Germany, since 2019).
- Reviewer for scientific journals, such as Applied Physics Letters, Scientific Reports, Diamond and Related Materials, Physica Status Solidi (a), Surface & Coatings Technology, Materials Chemistry and Physics, Thin Solid Films, Carbon, Vacuum, Journal of Nanomaterials, Material Letters, Biomaterials, applied surface science, ACS Biomaterials Science & Engineering, Sensors and actuators B, Coatings, etc.