

**Zdeněk Hubička, Ph.D.**

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#### PROFESSIONAL INTERESTS / RESEARCH EXPERTISE

The research is oriented on investigation of HIPIMS pulse, MF and RF reactive magnetron sputtering of semiconductor thin films for photocatalytic, solar water splitting, solar cells and sensory applications. Oxide and sulphide semiconductors were investigated as TiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, ZnO, WO<sub>3</sub>, CuFeO<sub>2</sub>, FeS<sub>2</sub>, WS, MoS<sub>2</sub>, etc.

Plasma parameters are investigated by means of various plasma diagnostic methods as Langmuir probe, RF probe methods, energy resolved mass spectroscopy and optical emission spectroscopy.

Low temperature multi plasma jets deposition systems based on MW surfatron and pulsed DC hollow cathodes are investigated as sources for PECVD and PVD thin films deposition.

Z. Hubička is currently head of Department of Low-Temperature Plasma in the Institute of Physics ASCR (FZU) since 2006 where he is leading 22 people. He was already leader of several grant projects teams which were focused on basic and applied research. He was leader of the team in FZU included in consortium of EU FP7 project HIPPOCAMP.

#### EDUCATION

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|-------------|--|
| 1999 – 2000 | <b>Postdoctoral position,</b><br>1999 – 2000 Robert and Marion Stevens postdoctoral fellowship<br>University of Nebraska Lincoln (USA), Department of Electrical<br>Engineering  |
| 1995 – 1998 | <b>Doctoral studies</b> – Physics of plasma and ionized media, Charles<br>University in Prague, Faculty of Mathematics and Physics, Czech<br>Republic, Topic: <i>The research of physical properties and applications RF<br/>multi-plasma jet deposition system.</i> |
| 1990 – 1995 | <b>Master studies</b> – Physical Electronics and Vacuum Physics, Charles<br>University in Prague, Faculty of Mathematics and Physics, Czech<br>Republic, Topic: The study of supersonic low temperature plasma jet<br>with the substrate.                            |

#### PROFESSIONAL EXPERIENCE

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|-----------|--|
| 1995-1998 | Institute of Physics AS CR (Ph.D. work)            |
| 1999-2000 | postdoctoral fellowship University of Nebraska USA |
| 2000-2006 | researcher Institute of Physics AS CR              |
| 2006-now  | Head of Department of Low-Temperature Plasma       |

#### PUBLICATION ACTIVITIES

***h*-index of 28 (Scopus), as of November 2022**

Author or co-author of 175 scientific articles in international peer-reviewed journals that received > 2200 citations (Scopus *h*-index 28), 17 publications in the last 3 years. Author or

co-author of 14 patents and 20 utility models. Author or co-author of 2 book chapters. Six invited talks at international conferences.

**Selected 5 most important papers since 2017:**

- 1 A. Hrubantová, R. Hippler, H. Wulff, M. Čada, J. Olejníček, N. Nepomniashchaia, C. A. Helm, Z. Hubička, Deposition of tungsten oxide films by reactive magnetron sputtering on different substrates. *J. Vac. Sci. Technol. A* 40 (2022) 063402(1) - 063402(7). doi: 10.1116/6.0002012
- 2 Z. Hubička, M. Zlámal, J. Olejníček, D. Tvarog, M. Čada, J. Krýsa, Semiconducting p-Type Copper Iron Oxide Thin Films Deposited by Hybrid Reactive-HiPIMS + ECWR and Reactive-HiPIMS Magnetron Plasma System, *Coatings* 10 (2020) 232(1) - 232(14). doi: 10.3390/coatings10030232
- 3 R. Hippler, M. Cada, Z. Hubicka, "Time-resolved Langmuir probe diagnostics of a bipolar high power impulse magnetron sputtering discharge", *Appl. Phys. Lett.* 116 (2020) 064101, doi: 10.1063/1.5140650
- 4 Z. Hubička, M. Zlámal, M. Čada, Š. Kment, J. Krýsa, Photo-electrochemical stability of copper oxide photocathodes deposited by reactive high power impulse magnetron sputtering Photo-electrochemical stability of copper oxide photocathodes deposited by reactive high power impulse magnetron sputtering *Catal. Today* 328 (2019) 29 - 34. doi: 10.1016/j.cattod.2018.11.034
- 5 J. Vyskocil, P. Mares, Z. Hubicka, M. Cada, T. Mates, Hybrid HiPIMS + controlled pulsed arc for deposition of hard coatings, *Surf. Coat. Technol.* 446 (2022) 128765, doi: 10.1016/j.surfcoat.2022.128765

**APPLICATION RESULTS**

- 1 CZ patent No. 309261, Z. Hubička, M. Čada, P. Kšířová, R. Houha, L. Matulová, Optical semiconducting thin film, method of its production, equipment suitable for the production of this layer and reading devices
- 2 EP Patent No. 3520131: A method for controlling the deposition rate of thin films in a vacuum multi-nozzle plasma system and a device for performing of the method.
- 3 EP Patent No. 3788181: Method of low-temperature plasma generation, method of an electrically conductive or ferromagnetic tube coating using pulsed plasma and corresponding devices.
- 4 CZ Utility model No. 35 307, Z. Hubička, M. Čada, P. Kšířová, R. Houha, L. Matulová, Optical semiconductor element.
- 5 CZ patent No. 307505, Z. Hubička, M. Čada, J. Olejníček, Š. Kment, V. Straňák, P. Adámek : A method of measuring the impedance of the deposited layer in the discharge plasma using and a device for performing this method.

**RESEARCH GRANTS (in last 7 years)**

Since 2016 acquired more than 1 million Euro on research grants:

		International
2017 – 2021	2017FV20580 (MPO TRIO): Planar optical structures and security elements based on multilayer systems Co-PI.	-
2022 - 2023	CZ.01.1.02/0.0/0.0/21_374/0026818 (MPO-OPPIK Aplikace) Transmission optical elements for the security of banknotes and documents using selective deposition of a thin layer structure Co-PI.	-
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## Curriculum Vitae

2017 – 2019	17-20008S Grant Agency of the Czech Republic Advanced photocathode and photoanode materials for solar water splitting Co-PI.	
2013 - 2016	FP7 EU; project Hippocamp no. 608800; High-power Impulse Plasma Process Operations for the Creation of Advanced Metallic Parts Co-PI.	Yes
2020 - 2022	NCK MATCA TACR subproject TN01000038/11 Plasma Coating II PI	

### INVITED TALKS AT INTERNATIONAL CONFERENCES

1. Z. Hubička, et al., High Power Pulse Plasma Systems for the Reactive Deposition of Thin Films at Low Substrate Temperature ICMCTF San Diego USA 2013
2. Z. Hubička, et al., Hybrid Reactive High Power Impulse Magnetron Sputtering System Combined with Electron Cyclotron Wave Resonance (ECWR) Plasma used for the Deposition of Semiconducting Thin Films ICMCTF San Diego USA 2019
3. Z. Hubička, et al., Semiconducting Oxide and Sulphide Thin Films Deposited by Reactive High Power Impulse Magnetron Sputtering CIP MIATEC Nice France 2017
4. Z. Hubička, et al., Plasma parameters control in reactive pulsed magnetron sputtering of semiconductor thin films, Frontiers in Low Temperature Plasma Diagnostics, Levico Terme – Italy 2022
5. Z. Hubička, et al. Reactive pulsed plasma deposition of semiconductor thin films for photoelectrochemical applications, plenary talk JVC Olomouc, Czech Republic 2018

### AWARDS and FELLOWSHIPS

2019 – now	<b>Member GAUK (Grant Agency of Charles University) panel</b>
2007	<b>The Otto Wichterle Award</b> for young researchers.
2019 - now	Subject area board for Ph.D. study: <b>Physics of plasma and ionized gasses Faculty of Mathematics and Physics Charles University Prague Czech Republic</b>

### TEACHING ACTIVITIES AND SUPERVISION OF STUDENTS

2010 – now	Supervisor of bachelor and doctoral students: successfully defended 2 bachelors, currently studying 2 doctoral student.
2005 – 2018	Undergraduate course <b>“Applied electronics”</b> , University of South Bohemia in České Budějovice, Faculty of Science.
2018 – now	Undergraduate study course <b>“Electronics I” and “Electronics II</b> , University of South Bohemia in České Budějovice, Faculty of Science.
2017 – now	graduate course <b>“Modeling of Electronic circuits”</b> , University of South Bohemia in České Budějovice, Faculty of Science.
2020 – now	graduate course <b>“Preparation and characterization of photonic nanostructures”</b> , University of Palacký, Faculty of Science, Olomouc.
2020 - now	Ph. D. course <b>“Low Temperature Plasma”</b> University of Palacký, Faculty of Science, Olomouc.

**COMMISSIONS OF TRUST AND SERVING SCIENTIFIC COMMUNITY**

2002 – now      **Reviewer** for journals Surface and Coating technology, Thin Solid Films, Journal of Applied Physics, Plasma Sources Science and Technology, Vacuum, Journal of Vacuum Science and Technology A, Journal of Physics D: Applied Physics.