

**Head of the Department: Prof. Jerzy Ratajski, Ph.D., D.Sc.**

## About the Department

The Department of Biomedical Engineering consists of ten staff members. Eight of them are scientific and didactic staff members, including two full professors and one associate professor. The strategic goal of the Department are activities aimed at the economic development of the Middle Pomerania Region and Pomerania Euroregion, which are based on environmentally friendly modern technologies and design and operation of advanced medical equipment. Department members are also engaged in a range of activities outside the University, which has an inspiring influence on teaching and research process.

## Teaching

The Department's teaching work comprises the area of technological sciences (disciplines: materials engineering, electronics, electrical engineering), the area of medical sciences, and the area of mathematical sciences (discipline: mathematics).

The Department's staff members teach the following subjects:

- Medical propedeutics
- Human anatomy and physiology
- Sensor and measurement techniques
- Sensor and measurement techniques – lab
- Electrotechnics and electrical machines in biomedical engineering
- Medical imaging
- Medical imaging – lab
- Electronic medical equipment
- Medical equipment – lab
- Information technology (IT)
- Technology and medicine
- Computational methods in biomedical engineering
- Bioinformatics

## Scientific and research activity

**Scientific and research activity of the Department of Biomedical Engineering is concentrated on the following areas:**

- Oncotherapy
- Radiology
- Biomaterials (especially nanopowders and nanofibers)
- Mathematical modeling of PVD and CVD processes
- Development of mathematical models for effective design of processes of shaping biomaterials applications
- Design of structure and chemical composition of multilayer and gradient PVD coatings

All the research projects at the Department are aimed at the development of diagnostic and measurement techniques and their clinical applications. Research works are conducted in cooperation with hospitals in the West Pomeranian region and with Medical Universities.

The Department staff members are co-organizers of a number of international scientific workshops and conferences, especially *International Forum on Innovative Technologies for Medicine ITMED* and *Nanomaterials session: Synthesis, Characterization & Applications* which is a part of the *International Conference on Surface, Coatings and Nanostructured Materials NANOSMAT*.

The Department cooperates with leading companies and institutions from the area of biomedical engineering and medicine:

- AFFIDEA
- Meden Inmed Koszalin
- FRK Zabrze
- Medgal Księżyno
- LFC Zielona Góra

The Department staff members cooperate with many national and international scientific centres such as: the Pomeranian Medical University in Szczecin, the Medical University of Łódź, the Łódź University of Technology, the Foundation of Cardiac Surgery Development named after prof. Zbigniew Religa in Zabrze, the AGH University of Science and Technology in Kraków, the Warsaw University of Technology, the

## Research projects

The Department of Biomedical Engineering carries out the following research projects under the agreements with the National Science Centre:

PROJECT TITLE	PROJECT COORDINATOR	PROJECT TYPE	DURATION
Investigations of stresses states evolution in multilayer protective coatings deposited via PVD method.	Łukasz Szparaga, Ph.D.	PRELUDIUM	2012-2014
Modification of diamond powder in rotational chamber of plasma-chemical reactor.	Przemysław Ceynowa, M.Sc.	PRELUDIUM	2012-2014
Development of control module of gas nitriding process based on complementary interaction with mathematical model and the magnetic sensor readings registering layer nucleation and growth.	Prof. Jerzy Ratajski	SUPERVISOR'S RESEARCH GRANT 2009-2010	

International projects:

PROJECT TITLE	PROJECT COORDINATOR	PROJECT TYPE	DURATION
Alternative coatings to cadmium and hard chromium with potential for second-generation developments.	Prof. Jerzy Ratajski,	Research project within the framework of CORNET initiative (Collective Research NETWORKING)	2014-2015

## Selected publications

- [M. Fijałkowski](#), [A. Karczemska](#), [J. Łysko](#), [R. Zybala](#), [M. Kozanecki](#), P. Filipczak, V. Ralchenko, M. Walock, A. Stanishevsky, [S. Mitura](#), Nanostructured Diamond Device for Biomedical Applications, [JOURNAL OF NANOSCIENCE AND NANOTECHNOLOGY](#),

Tom: 15, 2015: 2, pp: 1006-1013.

- [J. Witych](#), M. Wachowicz, P. Banatkiewicz, [S. Mitura](#), [I. Gisterek](#), Kardiotoksyczność w leczeniu raka piersi, [INŻYNIER I FIZYK MEDYCZNY](#), Tom: 4, 2014, Zeszyt: 3
- [P. Ceynowa](#), [J. Witych](#), P. Rytczak, [K. Kubiak](#), [M. Kołodziejczyk](#), [K. Mitura](#), S. Krzewiński, K. Symonowicz, [S. Bielecki](#), [S. Mitura](#), Synteza nanowłókna z bionanocelulozy (BNC), [Elektronika: konstrukcje, technologie, zastosowania](#), Tom: 10, 2014, 17-18
- S. Mitura, P. Niedzielski, B. Walkowiak (Eds.) NANODIAM, New technologies for medical applications: studying and production of carbon surfaces allowing for controllable bioactivity. PWN, Warszawa 2006, 290 stron.
- P Myśliński, Ł Szparaga, P Kamasa, A Gilewicz, J Ratajski: Application of dilatometry with modulated temperature for thermomechanical analysis of anti-wear coating/substrate systems. *Journal of Thermal Analysis and Calorimetry* 119, 1-7 (2015)
- Ł Szparaga, P Myśliński, A Gilewicz, J Ratajski: Investigations on the Thermo-Mechanical Properties of CrN/CrCN Gradient Coatings Using a Thermo-Dilatometric Method. *Solid State Phenomena* 223, 100-109 (2015)
- Ł Szparaga, J Ratajski: Pareto Optimal Multi-Objective Optimization of Antiwear TiAlN/TiN/Cr Coatings. *Advances in Materials Science* 14 (1), 5-13 (2014)
- A Gilewicz, R Olik, Ł Szparaga, J Ratajski: The properties of multi-module and gradient coatings base on CrN/CrCN deposited on nitrided 4140 steel. *Problemy Eksploatacji - Maintenance Problems* 94 (3), 27-43 (2014)
- Ł Szparaga, J Ratajski, P Barosik: Strain field analysis in nanoindentation test of gradient coatings. *Archives of Materials Science and Engineering* 64 (2), 219-227 (2013)
- P Myśliński, Ł Szparaga, A Gilewicz, R Olik, J Ratajski: Dylatometryczna metoda detekcji efektów termomechanicznych w powłokach gradientowych CrCN/CrN. *Inżynieria Materiałowa* 196 (6), 773-776 (2013)
- J Ratajski, Ł Szparaga: On transition functions and nonlinearity measures in gradient coatings. *Journal of Achievements in Materials and Manufacturing Engineering* 54 (1) 83-92 (2012)
- B Warcholinski, A Gilewicz, J Ratajski, Z Kuklinski, J Rochowicz An analysis of macroparticle-related defects on CrCN and CrN coatings in dependence of the substrate bias voltage, 2012/3/14 *Vacuum*, 86, 1235-1239
- Ł Szparaga, J Ratajski: Modelowanie ewolucji stanów naprężeń w wielowarstwowej powłoce CrN/Cr za pomocą MES. *Inżynieria Materiałowa* 182 (4), 760-763 (2011)
- R. Olik, B. Warcholiński, J. Ratajski J. Michalski, Zastosowanie metody Taguchi do optymalizacji parametrów procesu azotowania gazowego, *Inżynieria Powierzchni* 2011, 4, 3-7.
- B. Warcholinski, A. Gilewicz, J. Ratajski, Z. Kuklinski, J. Rochowicz, An analysis of macroparticle-related defects in the CrCN and CrN coatings in dependence on the substrate bias voltage, *Vacuum*, 2011, 1-5

- B. Warcholiński, A. Gilewicz, J. Ratajski, Cr<sub>2</sub>N/CrN multilayer coatings for wood machining tools, *Tribology International* 44 (2011), 1076-1082
- J Ratajski, R Olik, B Warcholiński, A Gilewicz, J Michalski, J Kwiatkowski, Ł. Szparaga: Przeciwzużyciowa, dwustopniowa obróbka powierzchniowa narzędzi stosowanych w przemyśle drzewnym. *Inżynieria Materiałowa* 176 (4), 1177-1182 (2010)
- Ratajski J., Olik R. , Suszko T., Dobrodziej J. and Michalski J. Design, Control and in Situ Visualization of Gas Nitriding Processes, *Sensors*, 10, 2010, 218-240.
- Ratajski J., Olik R. Development of nitrided layer during nitriding of steel, *Advances in Materials and Processing Technologies* 2010, 1025-1034
- Ratajski J., Olik R. , Suszko T., Dobrodziej J. and Michalski J.: Proiectarea, Controlul, Si Vizualizarea In Situ A Procesului De Niturare Gazoasa, *Tratamente Termice Si Ingineria Suprafetelor, Partea-a* , 1, 2010, 32-54.
- Ratajski J., Olik R. , Suszko T., Dobrodziej J. and Michalski J.: Proiectarea, Controlul, Si Vizualizarea In Situ A Procesului De Niturare Gazoasa, *Tratamente Termice Si Ingineria Suprafetelor, Partea-b* , 2, 2010, 25-41.
- L Szparaga, W Tarnowski, A Plawgo, P Bartosik: Vibro-acoustic method for estimating a liquid level and viscosity. *PAMM* 9 (1), 685-686 (2009)
- Kosikowski M., Suszyński Z., Olik R., Ratajski J., Suszko T. The application of artificial neural networks and evolutionary algorithm the designing of gas nitriding process, *International Book Series Information Science and Computing*, 2009, 33-38.
- Ratajski J.: Relation between phase composition of compound zone and growth kinetics of diffusion zone during nitriding of steel, *Surface and Coatings Technology* 203 (2009) 2300–2306.
- Katarzyna Mitura, Piotr Niedzielski, Grzegorz Bartosz, Jacek Moll, Bogdan Walkowiak, Zofia Pawłowska, Petr Louda, Marta Kieć–Świerczyńska, Stanisław Mitura; *Interactions between Carbon Coatings and Tissue*, *Surface Coatings Technology*, 200 (2006).
- S. Mitura, K. Mitura, P. Niedzielski, Petr Louda, V. Danilenko; *Nanocrystalline diamond, its synthesis, properties and applications*, *Journal of Achievements in Materials and Manufacturing Engineering*, 16 (2006) 9-16.
- K.Mitura, A.Karczemska, P.Niedzielski, J.Grabarczyk, W.Kaczorowski, P.Louda, and S.Mitura, ‘*Nanocrystalline carbon coatings and powders for medicine*’, *Int. J. Nanomanufacturing*, Vol. 2, Nos. 1/2, (2008) pp.29–39.
- D.Batory, T.Blaszczyk, M.Clapa, S.Mitura: “[\*Investigation of anti-corrosion properties of Ti:C gradient layers manufactured in hybrid deposition system\*](#)”, *Journal of Materials Science*, Springer US, vol. 43, no. 10, (2008) 3385-3391.
- S.Mitura: Novel synthesis nanocrystalline diamond films, chapter 4 in: K.-L.Choy (ed.), *INNOVATIVE PROCESSING of FILMS & NANOCRYSTALLINE POWDERS*, IC Press, London, 2002.
- Marian Cłapa; Stanisław Mitura, Piotr Niedzielski; Anna Karczemska; John

Hassard: „*Colour carbon coatings*” [Diamond and Related Materials](#) Volume: 10, Issue: 3-7, March - July, 2001, pp. 1121-1124.

· K.Bąkiewicz, S.Mitura: „*Biocompatibility of NCD*”, *Journal of Wide Bandgap Materials*, Vol. 9, No. 4 – April (2002), 261-272.

· S.Mitura (Editor): *NANOTECHNOLOGY in MATERIALS SCIENCE*, ELSEVIER, Pergamon Press Amsterdam, Lausanne, New York, Oxford, Shannon, Singapore, Tokyo, 2000, pp. 209.