

ENGINEERING OF BIOMATERIALS

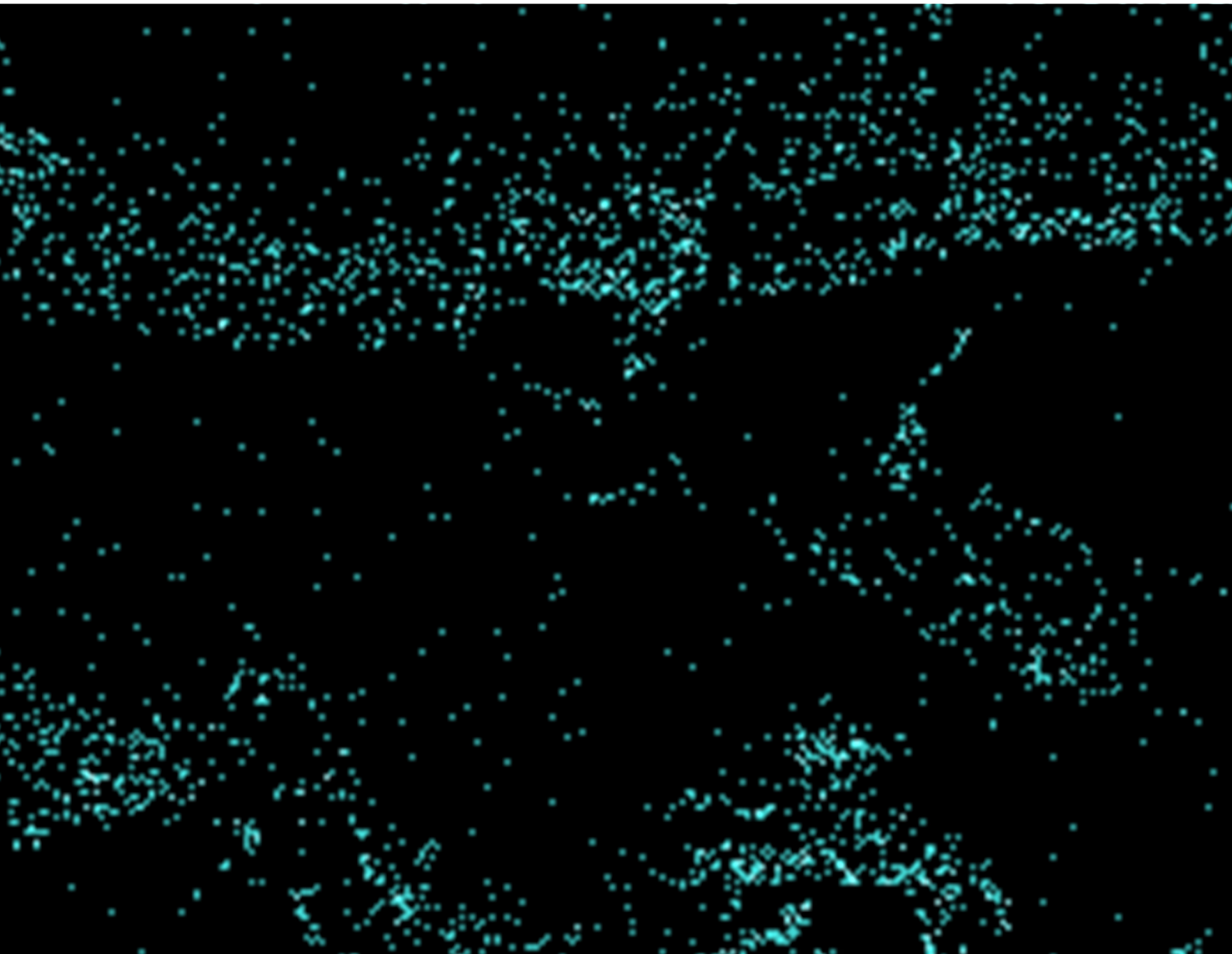
THE OFFICIAL JOURNAL OF THE POLISH SOCIETY FOR BIOMATERIALS
AND THE FACULTY OF MATERIALS SCIENCE AND CERAMICS / AGH UNIVERSITY OF KRAKOW

Number
173

Volume
XXVIII

Year
2025

ISSN
3071-7825



PUBLISHER: Polish Society for Biomaterials

EDITORIAL OFFICE:

EDITORIAL COMMITTEE:

Editor-in-Chief: Elżbieta Pamuła

Editors: Timothy E.L. Douglas & Patrycja Domalik-Pyzik

Secretary of Editorial & Design: Katarzyna Trała

AGH University of Krakow
Faculty of Materials Science and Ceramics
al. A. Mickiewicza 30, building A-3
30-059 Krakow, Poland

www.biomaterials.pl

Open access, peer-reviewed and free of charge journal issued since 1997

• MNiSW: 20 • ICV: 100 • ORCID • DOI: 10.34821/eng.biomat. • CC BY 4.0 license •

Included in: DOAJ (Directory of Open Access Journals) • CAS (Chemical Abstracts Service)
• Index Copernicus (ICI Journals Master list) • BazTech

EDITORIAL COMMITTEE

EDITOR-IN-CHIEF

Prof. Elżbieta Pamuła - AGH University of Krakow, Poland

EDITORS / ASSOCIATE EDITORS

Dr. Timothy E.L. Douglas - Lancaster University, United Kingdom

Dr. Patrycja Domalik-Pyzik - AGH University of Krakow, Poland

SECRETARY OF EDITORIAL & DESIGN

MSc Katarzyna Trała - AGH University of Krakow, Poland

INTERNATIONAL EDITORIAL BOARD

Iulian Antoniac - University Politehnica of Bucharest, Romania

Lucie Bacakova - Academy of Science of the Czech Republic, Prague, Czech Republic

Romuald Będziński - University of Zielona Góra, Poland

Marta Błażewicz - AGH University of Krakow, Poland

Stanisław Błażewicz - AGH University of Krakow, Poland

Aldo Boccaccini - Friedrich Alexander University Erlangen-Nuremberg, Germany

Gary L. Bowlin - The University of Memphis, USA

Maria Chatzinikolaïdou - University of Crete, Heraklion, Greece

Wojciech Chrzanowski - University of Sydney, Australia

Jan Ryszard Dąbrowski - Białystok Technical University, Poland

Christine Dupont - Université Catholique de Louvain, Belgium

Matthias Epple - University of Duisburg-Essen, Germany

Lino Ferreira - University of Coimbra, Portugal

Michael Gelinsky - Dresden University of Technology, Germany

Håvard J. Haugen - University of Oslo, Norway

Robert Hurt - Brown University, Providence, USA

Sachiro Kakinoki - Kansai University, Osaka, Japan

Ravichandran Kandaswamy - Anna University, Chennai, India

James Kirkpatrick - Johannes Gutenberg University, Mainz, Germany

Joachim Kohn - Rutgers - The State University of New Jersey, USA

Ireneusz Kotela - Central Clinical Hospital of the Ministry of the Interior and Administr. in Warsaw, Poland

Didier Letourneur - Université Sorbonne Paris Nord, France

Małgorzata Lewandowska-Szumieł - Medical University of Warsaw, Poland

Jānis Ločs - Riga Technical University, Latvia

Diego Mantovani - Laval University, Quebec City, Canada

Jan Marciniak - Silesian University of Technology, Zabrze, Poland

Jonathan Massera - Tampere University, Finland

Bożena Michniak-Kohn - Rutgers - The State University of New Jersey, USA

Ion N. Mihailescu - National Institute for Laser, Plasma and Radiation Physics, Bucharest, Romania

Sergey Mikhailovsky - ANAMAD Ltd., Sussex Innovation Centre, Brighton, United Kingdom

Stanisław Mitura - Technical University of Liberec, Czech Republic

Werner E.G. Müller - University Medical Center of the Johannes Gutenberg University Mainz, Germany

Piotr Niedzielski - Technical University of Lodz, Poland

Miguel Oliveira - University of Minho, Guimarães, Portugal

Abhay Pandit - National University of Ireland, Galway, Ireland

Emmanuel Pauthe - CY Cergy Paris University, Cergy-Pontoise, France

Ana Paula Pêgo - University of Porto, Portugal

Laetitia Petit - Tampere University, Finland

Stanisław Pielka - Wrocław Medical University, Poland

Rui L. Reis - University of Minho, Guimarães, Portugal

Vehid Salih - UCL Eastman Dental Institute, London, United Kingdom

Matteo Santin - University of Brighton, United Kingdom

Olafur Eysteinn Sigurjonsson - Reykjavik University, Iceland

Paweł Sikorski - Norwegian University of Science and Technology (NTNU), Norway

Jacek Składzień - Jagiellonian University, Collegium Medicum, Krakow, Poland

Izabela C. Stancu - National University of Science and Technology Politehnica of Bucharest, Romania

Andrei V. Stanishevsky - University of Alabama at Birmingham, USA

Martin Stoddart - AO Research Institute Davos, Switzerland

Tadeusz Trzaska - University School of Physical Education, Poznań, Poland

Dimitris Tzipas - Aristotle University of Thessaloniki, Greece

Małgorzata Włodarczyk-Biegun - University of Groningen, The Netherlands

TABLE OF CONTENTS No. 173(2025)

- 01 **Rheological characteristics of composites based on carboxymethyl chitosan**
Katarzyna Lewandowska, Sandra Lewandowska
- 02 **Drosophila melanogaster as a model organism for nanoparticle toxicity research**
Weronika Łakomy, Maria Myślińska, Ewa Tarnawska, Karolina Kulig, Aleksandra Owczarzy,
Wojciech Rogóż, Małgorzata Maciążek-Jurczyk
- 03 **In vitro cytotoxicity and physicochemical evaluation of freeze-dried hydrogel delivery systems of hydrocortisone**
Kacper Odziomek, Sandra Komaniecka, Katarzyna Bialik-Wąs
- 04 **Chitosan films with quercetin for skin applications**
Marzanna Kurzawa, Katarzyna Lewandowska, Alina Sionkowska
- 05 **Physicochemical characterization of ionically cross-linked hydrogel matrices with incorporated fananserin derivative**
Sandra Komaniecka, Kacper Odziomek, Przemysław Zaręba, Katarzyna Bialik-Wąs
- 06 **Novel antioxidant materials based on polysaccharides containing resveratrol and syringic acid**
Karolina Kulka-Kamińska, Marzanna Kurzawa, Alina Sionkowska
- 07 **Lipid-based nanocarriers for efficient delivery of lipophilic nutraceuticals**
Justyna Bednorz, Szczepan Zapotoczny
- 08 **Influence of silver nanoparticles on mechanical and antimicrobial properties of selected reinforced PC and HDPE composites**
Kayode Adebisin, Anna Kłeczek, Mateusz Galeja, Jadwiga Gabor, Jarosław Markowski,
Andrzej S. Swinarew
- 09 **Chitosan-based films with selected moisturizing additives**
Beata Kaczmarek-Szczepańska, Patrycja Glajc, Lidia Zasada
- 10 **Chitosan films incorporated with mastic oil for potential application in biomaterials: Physicochemical characterization**
Patrycja Brudzyńska, Alina Sionkowska
- 11 **Influence of surface preparation of implantable Ti6Al4V alloy on properties of Si-DLC and DLC carbon coatings**
Agata Niedzielska, Milena Kowalska, Witold Szymański, Piotr Niedzielski, Witold Kaczorowski,
Jacek Grabarczyk
- 12 **Design and development of multilayered functionalized artificial skin for prosthetic applications: a biomimetic approach**
Dominika Adamczyk, Piotr Szatkowski, Oliwia Grątek, Martyna Fröhlich, Justyna Matysek
- 13 **Evaluation of the hemolytic properties of carbon nanomaterials**
Marcelina Procyk, Marta Kutwin
- 14 **Design of the manufacturing conditions to increase curcumin loading in polyanhydride microparticles**
Julie Borreau, Konrad Kwiecień, Anna Kusibab, Elżbieta Pamuła

SPONSORED MATERIAL: The project “Infrastructural Support for the Research and Development of Innovative, Energy-Efficient, Pro-Ecological Materials and Technologies for Applications in Transport Vehicles, Technological Machinery and Medicine”

ABOUT THE JOURNAL

The journal „Engineering of Biomaterials” publishes refereed original articles and review papers on biomedical aspects of engineering. It deals with application of materials engineering principles and methods to problems associated with human health. This includes the design and manufacturing of biocompatible materials, implants, artificial organs, controlled drug delivery systems and various medical devices. The journal encourages to present the research results focused on the areas of biomaterials technology and analysis of interaction between implant surfaces and the biological environment/living tissue to improve the biocompatibility and the biofunctionality of biomaterials.

The scope of the journal includes topics such as:

- Materials Science
(Ceramics, Polymers, Metals and Alloys, Composites)
- Biocybernetics and Biomedical Engineering
- Cell & Tissue Engineering
- Biotechnology
- Chemical Engineering
- Nanotechnology
- Surfaces, Coatings & Films
- Medicine
- Veterinary Science

Open Access Statement

The journal „Engineering of Biomaterials” is an online-only, open access journal, which means that all its content is freely available without charge. Publication under the Creative Commons Attribution 4.0 (CC BY) license allows users to read, download, copy, distribute, print, search, or link to the full texts of the articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author, as long as they cite the source. This is in accordance with the BOAI definition of open access.

SUBMISSIONS

Detailed information concerning manuscript preparation, reviewing procedure and journal policy are available at the journal's website:

www.biomaterials.pl

Online submissions:

www.editorialsystem.com/biomaterials

Issues and contents:

www.biomaterials.pl/Archive

All published articles are provided with Digital Object Identifier (DOI)

EDITORIAL OFFICE

Journal „Engineering of Biomaterials”
 Polish Society for Biomaterials

AGH University of Krakow
 Faculty of Materials Science and Ceramics
 Department of Biomaterials and Composites
 al. A. Mickiewicza 30, building A-3
 30-059 Krakow, Poland
 tel. (48) 12 617 44 48, 12 617 25 61
 e-mail: epamula@agh.edu.pl, kabe@agh.edu.pl

INSTRUCTIONS FOR AUTHORS

1. Papers for publication should be written in English. Minimum length of manuscript - 8 pages.
2. All articles are reviewed.
3. The authors should enclose a statement, that the article is original, has not been published previously and is not under consideration for publication elsewhere.
4. The Editors lead the policy of “ghostwriting” and “guest authorship” prevention. The Editors require that authors should reveal individual co-authors’ contribution (in percentage). When submitting the manuscript, it is necessary to make a statement which of the authors contributed to: A - research concept and design, B - Collection and / or assembly of data, C - Data analysis and interpretation, D - Writing the article, E - Critical revision of the article, F - Final approval of the article. However, the corresponding author will chiefly be held responsible.
5. When submitting a manuscript, authors are asked to suggest at least four potential reviewers (title, first and last name, institution, e-mail). At least 2 reviewers should be from a country other than Poland. Reviewers may not be affiliated with the same institution as the author(s) and should not be in close personal or professional relationships with the author(s). The names of the reviewers may be (but not have to be) used by the Editorial Board.
6. A manuscript should be organized in the following order:
 • TITLE • Authors and affiliations • Abstract (200-250 words)
 • Keywords (4-6) • Introduction • Materials and Methods • Results and Discussion • Conclusions • Acknowledgements • References
7. Authors’ full names and affiliations with postal addresses should be given. If authors have different affiliations use superscripts ^{1,2}. ORCID iDs are required for all authors.
8. The papers (including figures, tables, references) should be submitted as MS WORD file (Arial 9 point size font with 1.5 line spacing). SI units should be used.
9. All illustrations, figures, graphs etc. should be additionally presented in separate electronic files (format .jpg, .gif, .tiff, .bmp). High-resolution figures are required for publication, at least 300 dpi. All figures must be numbered in the order in which they appear in the paper and captioned below. They should be referenced in the text (e.g. FIG. 1, FIG. 2a, TABLE 1). Any image that is adapted or copied directly from another source needs to come with copyright permission. The original source must be acknowledged in the figure caption, as requested by the publisher.
10. References should be listed at the end of the article. Number the references consecutively in the order in which they are first mentioned in the text. References should contain the authors’ names and initials, full title of the paper, name of the journal (full or using Journal Abbreviations Index), volume number, year of publication, first and last page numbers.
11. Opinion or notes of reviewers will be transferred to the author. If the corrected article will not be supplied on time, it means that the author has resigned from publication of work in our journal.
12. The Editors reserve the right to improve manuscripts on grammar and style and to modify the manuscripts to fit in with the style of the journal. If extensive alterations are required, the manuscript will be returned to the authors for revision.
13. Publisher does not pay royalties for publication of article.
14. Papers will not be considered for publication until all the requirements will be fulfilled.



wimic

WYDZIAŁ INŻYNIERII MATERIAŁOWEJ I CERAMIKI
AKADEMIA GÓRNICZO-HUTNICZA
IM. STANISŁAWA STASZICA W KRAKOWIE

Patronat
merytoryczny



Studia Podyplomowe „Biomateriały – Materiały dla Medycyny”

Charakterystyka studiów:

Tematyka prezentowana w trakcie zajęć obejmuje przegląd wszystkich grup materiałów dla zastosowań medycznych: metalicznych, ceramicznych, polimerowych, węglowych i kompozytowych. Uczestnicy zapoznają się z metodami projektowania i wytwarzania biomateriałów, a następnie możliwościami analizy ich właściwości mechanicznych, właściwości fizykochemicznych (laboratoria z metod badań: elektronowa mikroskopia skaningowa, mikroskopia sił atomowych, spektroskopia w podczerwieni, badania energii powierzchniowej i zwilżalności, badania reologiczne, termiczne, mechaniczne) oraz właściwości biologicznych (badania *in vitro* i *in vivo*). Omawiane są także regulacje prawne i aspekty etyczne związane z badaniami na zwierzętach (norma EU ISO 10993) i badaniami klinicznymi, a także najnowsze osiągnięcia inżynierii tkankowej i nanomedycyny.

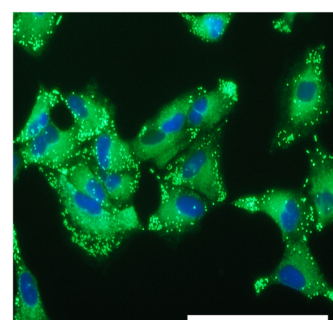
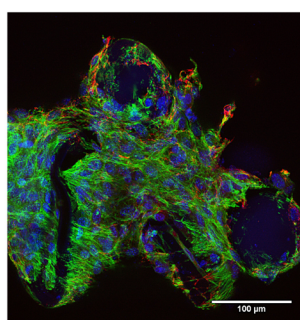
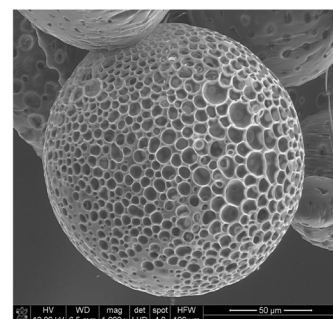
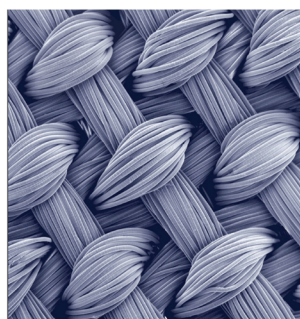
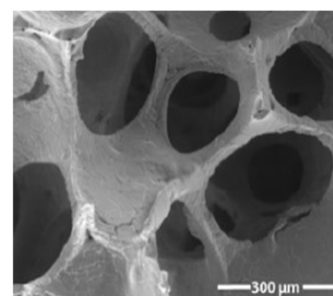
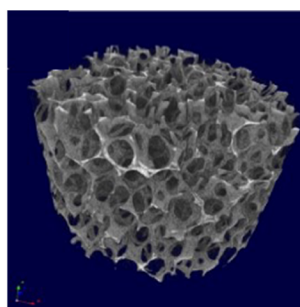
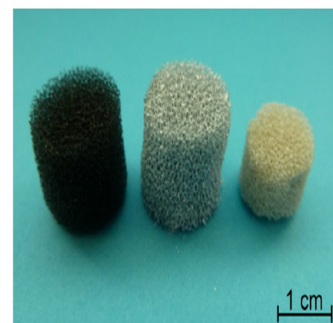
Termin zgłoszeń: 1-30 września

Tryb zgłoszeń: kolejność zgłoszeń

Opłaty: 4 000 zł (za dwa semestry)

Czas trwania: 2 semestry

Zajęcia: osiem zjazdów (soboty-niedziele) raz w miesiącu (AGH Kraków)



Zgłoszenia:

Dr inż. Katarzyna Reczyńska-Kolman
Sekretarz Studiów Podyplomowych
tel. 12 617 23 38
kmr@agh.edu.pl

Prof. dr hab. inż. Elżbieta Pamuła
Kierownik Studiów Podyplomowych
tel. 12 617 44 48
epamula@agh.edu.pl





35th Biomaterials in Medicine and Veterinary Medicine Anniversary Conference

8 – 11 October 2026 Rytro, Poland

SAVE THE DATE

8-11

OCTOBER
2026

www.biomat.agh.edu.pl



REGISTER
AND
SUBMIT
AN ABSTRACT

