Wrocław University of Technology

27th European Conference on Biomaterials ESB2015

Dr Beata Borak
Dr inż. Anna Donesz-Sikorska
Katedra Mechaniki i Inżynierii Materiałowej, Politechnika Wrocławska

Wrocław University of Technology

27th European Conference on Biomaterials

30.08 - 3.09 2015, Centrum Kongresowe ICE, Kraków

ICE KRAKÓW CONGRESS CENTRE

Komitet organizacyjny:

Chair: Prof. Jan CHŁOPEK

Vice-Chair: Prof. Elżbieta PAMUŁA

Ministry of Science and Higher Education
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Narodowe Centrum Badań i Rozwoju

NARODOWE CENTRUM NAUKI

PAN

JAGIELLONIAN UNIVERSITY IN KRAKOW

WIMIC

AGH

KRAKÓW

Małopolska KRAKÓW Region

Tematyka konferencji, wystawcy

ESB 2015

1) Smart biomaterials
2) Surface modification and functionalization
3) Advanced manufacturing
4) Antimicrobial surfaces and materials
5) Biointerfaces
6) Bioimaging and biosensing
7) Tissue engineering / Regenerative medicine
8) Angiogenesis / Vascularization
9) Drug and gene delivery
10) Cell encapsulation and delivery
11) Stem cells
12) Cancer therapy
13) Bone and cartilage
14) Neural regeneration
15) Cardiovascular applications
16) Wound healing
17) Clinical trials
18) Translation and commercialization

BRUKER

BINDER
Best conditions for your success

nLab
Spółka z o.o.

Anton Paar

ebers
tissue engineering bioreactors

PLASMA GROUP SCIENCE

OXFORD
UNIVERSITY PRESS

JPK Instruments

Jellagen

THE ROYAL SOCIETY
PUBLISHING

Biolin Scientific
[Progress Together]

ARTERIUS

ELSEVIER

UNI-EXPORT
Instruments Polska

cambioceramics

Taylor & Francis Group
an informa business

SCANCO
MEDICAL

IOP Publishing

shim-pol

Springer

DSM

Panele tematyczne

1. Bone Tissue Engineering 1
2. Cartilage Tissue Engineering 1
3. Drug Delivery 1
4. Surface Modification 1
5. Cell Instructive Materials 1
6. Advanced Manufacturing 1
7. Osteointegration 1
8. Neural Regeneration 1
9. Drug Delivery 2
10. Surface Modification 2
11. Cell Instructive Materials 2
12. Cell Encapsulation and Delivery 1
13. Bioactive Materials
14. Stem Cells 1
15. Antimicrobial Surfaces and Materials 1
16. Gene Delivery
17. Biointerfaces 1
18. Smart Biomaterials 1
19. Wound Healing 1
20. Surface Modification 3
21. Cartilage Tissue Engineering 2
22. Cell Encapsulation and Delivery 2
23. Bone Tissue Engineering 2
24. Stem Cells 2
25. Surface Modification 4
26. Cell Instructive Materials 3
27. Bone Tissue Engineering 3
28. Angio- and Vasculogenesis
29. Antimicrobial Surfaces and Materials 2
30. Bioimaging and Biosensing
31. Biointerfaces 2
32. Cancer Therapy
33. Soft Tissue Engineering
34. Cardiovascular Applications 1
35. Antimicrobial Surfaces and Materials 3
36. Advanced Manufacturing 2
37. Drug Delivery 3
38. Composite Scaffolds
39. Cardiovascular Applications 2
40. Neural Regeneration 2
41. Cell Instructive Materials 4
42. Bone Tissue Engineering 4
43. Cellular Response
44. Wound Healing 2
45. Bone Cements
46. Nanoparticles
47. Neural Regeneration 3
48. Bone Tissue Engineering 5
49. Clinical Trials
50. Antimicrobial Surfaces and Materials 4
51. Biomimetic Materials
52. Osteointegration 2
53. Advanced Manufacturing 3
54. Bone Tissue Engineering 6
55. Cardiovascular Applications 3
56. Surface Modification 5
57. Smart Biomaterials 2
58. Drug Delivery 4

Special Symposia:
TRS - Translational Research Symposium
SCh - Surface Charge Symposium
SFI - Science for Industry Symposium

Wrocław University of Technology

Wykłady plenarne

ESB 2015

Joachim KOHN
The New Jersey Center for Biomaterials,
UNITED STATES
Title: "Bioactive materials for the treatment of major injuries: opportunities and challenges"
Monday, 31st August
9:00 – 9.45, Hall 1 (Auditorium)

Maria SIEMIONOW
University of Illinois at Chicago,
Department of Orthopaedics, UNITED STATES
Title: "Regenerative transplantation - from experimental laboratory to clinical applications"
Monday, 31st August
9:45 – 10:30, Hall 1 (Auditorium)

C. James KIRKPATRICK
Institute of Pathology, University Medical Center,Johannes Gutenberg University of Mainz, GERMANY
Title: "In vitro models & nanobiointerfaces: a multidisciplinary challenge"
Monday, 31st August
14:45 – 15:30, Hall 1 (Auditorium)

Geoff RICHARDS
AO Research Institute Davos, SWITZERLAND
Title: "Medical Translational Research: A different route to Fundamental Research"
Tuesday, 1st September
9:00 – 9:45, Hall 1 (Auditorium)

Michael V. SEFTON
Institute of Biomaterials and Biomedical Engineering,
University of Toronto, CANADA
Title: "Vascularization in tissue engineering: alternative foreign body responses"
Tuesday, 1st September
15:30 – 16:15, Hall 1 (Auditorium)

Kazunori KATAOKA
Department of Materials Engineering,
University of Tokyo, JAPAN
Title: "Targeted chemo- and molecular-therapy by self-assembled supramolecular nanosystems"
Wednesday, 2nd August
8:30 – 9:15, Hall 1 (Auditorium)

Małgorzata LEWANDOWSKA-SZUMIEŁ
Center for Biostructure Research,
Medical University of Warsaw, POLAND
Title: "Cell-made or man-made materials for bone reconstruction?"
Wednesday, 2nd August
15:30 – 16:15, Hall 1 (Auditorium)

Abhay PANDIT
Network of Excellence for Functional Biomaterials,
National University of Ireland, Galway, IRELAND
Title: "Biological-basis for designing biomaterials for the injured and degenerated host - examples in the neural space"
Thursday, 3rd September
9:00 – 9:45, Hall 1 (Auditorium)

Wrocław University of Technology

Uczestnicy, wystąpienia

8 Plenary Lectures

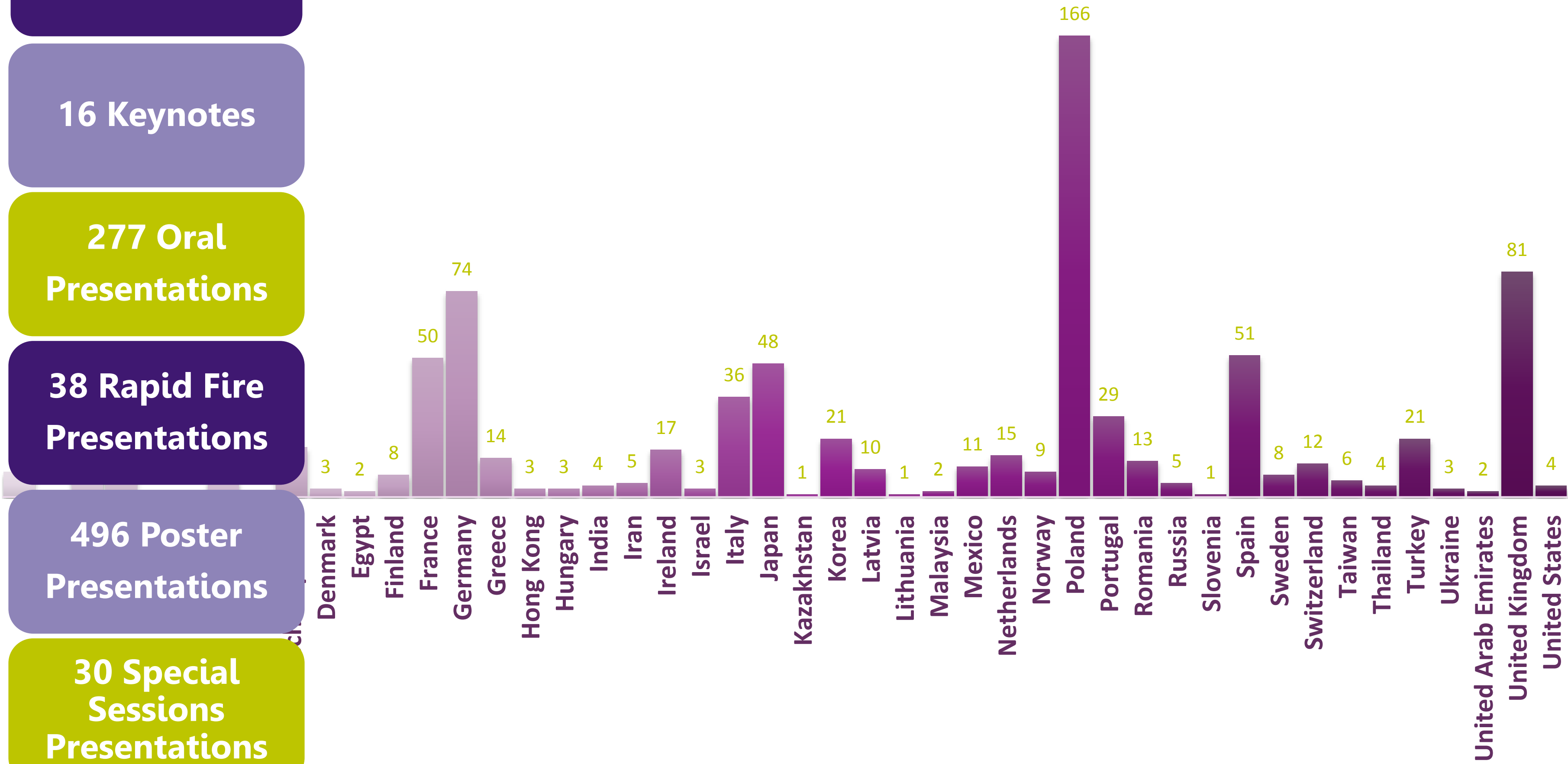
16 Keynotes

277 Oral Presentations

38 Rapid Fire Presentations

496 Poster Presentations

30 Special Sessions Presentations



Najbliższe konferencje

WBC2016

10th World Biomaterials Congress

May 18–22, 2016 | Montréal, Canada

ESB 2017

28th EUROPEAN CONFERENCE ON BIOMATERIALS

September 4-8, 2017 ATHENS GREECE

Najbliższe konferencje

ESB 2015

XXV CONFERENCE ON BIOMATERIALS IN MEDICINE AND VETERINARY MEDICINE

Save the date!
13-16 Oct 2016
Rytro, Poland

UNIQUE ATMOSPHERE

RICH SCIENTIFIC PROGRAMME

CONFERENCE CHAIR
PROF. JAN CHLOPEK

UNFORGETTABLE SOCIAL EVENTS

POLISH FOLK EVENING

STUNNING VIEWS

CELEBRATE WITH US

the 25th ANNIVERSARY CONFERENCE

Wrocław University of Technology

AGH

Bioactivation of SiO_2 sol-gel coatings by active molecules as a method of modification of metallic implants surface

Anna Donesz-Sikorska[1],

Justyna Krzak[1], Jerzy Kaleta[1], Małgorzata Krok-Borkowicz[2], Elżbieta Pamuła[2].

[1]Department of Mechanics, Materials Science and Engineering, Wroclaw University of Technology, Poland
[2]Department of Biomaterials, AGH University of Science and Technology, Poland

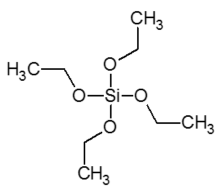
POSTER No 298

Materials and methods

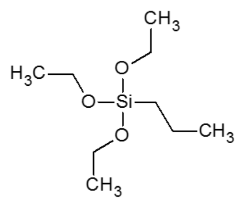
MATERIALS

Base SiO_2 coatings:
SiO_2 (TEOS+H_2O)*; SiO_2 (TEOS+EtOH)*; SiO_2 (PtEOS)*

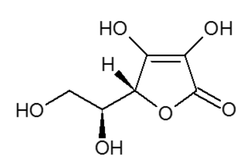
Functionalized SiO_2 coatings:
SiO_2*/0.4M LAA; SiO_2*/0.7M SAL; SiO_2/3.5M DOPA**



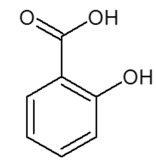
TEOS



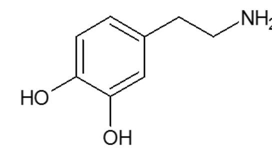
PtEOS



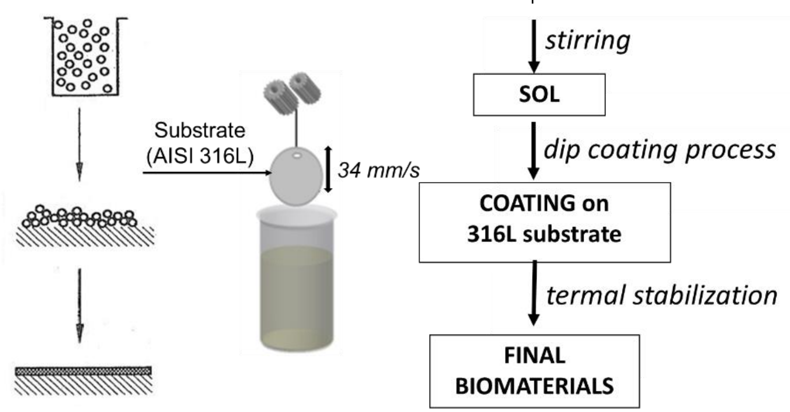
LAA



SAL



DOPA

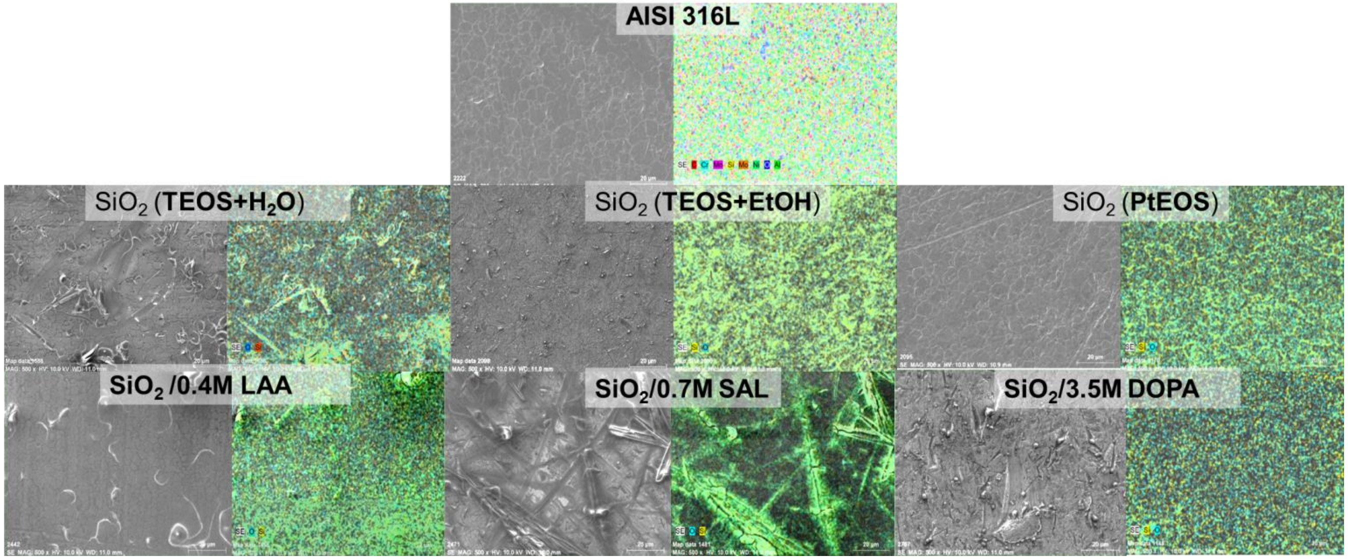


METHODS

1) **SEM-EDX analysis** → surface morphology and distribution of elements on metallic substrate
2) **Profilometry** → surface roughness
3) **Water contact angle** and **surface free energy (SFE)** → wettability, surface interactions
4) **Raman spectroscopy** → chemical composition (e.g. Si-O-Si, bands from active molecules)
5) **Electrochemical analysis** → corrosion resistance
6) **Biological assay** → biocompatybility evaluation *in vitro* using MG-63 cells

Results

SEM-EDX micrographs of obtained sol-gel coatings on AISI 316L:



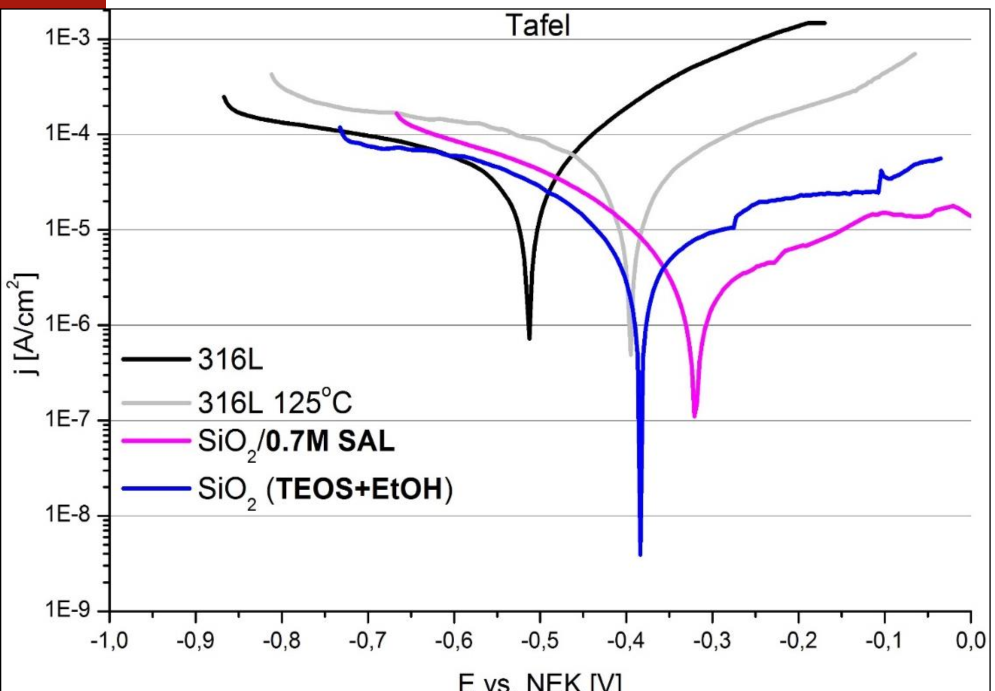
Wettability of sol-gel derived coatings:

Material	θ_w [°]	θ_{di} [°]	SFE [mJ/m²]	γ_d [mJ/m²]	γ_p [mJ/m²]
Pure steel AISI 316L	85.4 ± 7.2	96.20 ± 7.6	35.95 ± 0.20	32.86 ± 0.20	3.09 ± 0.01
SiO_2 **(TEOS+EtOH)**	82.2 ± 3.3	53.5 ± 5.3	36.60 ± 1.35	32.30 ± 1.05	4.30 ± 0.29
SiO_2/**0.7M SAL**	40.6 ± 2.3	30.6 ± 6.6	65.43 ± 2.27	43.99 ± 1.53	21.43 ± 0.74

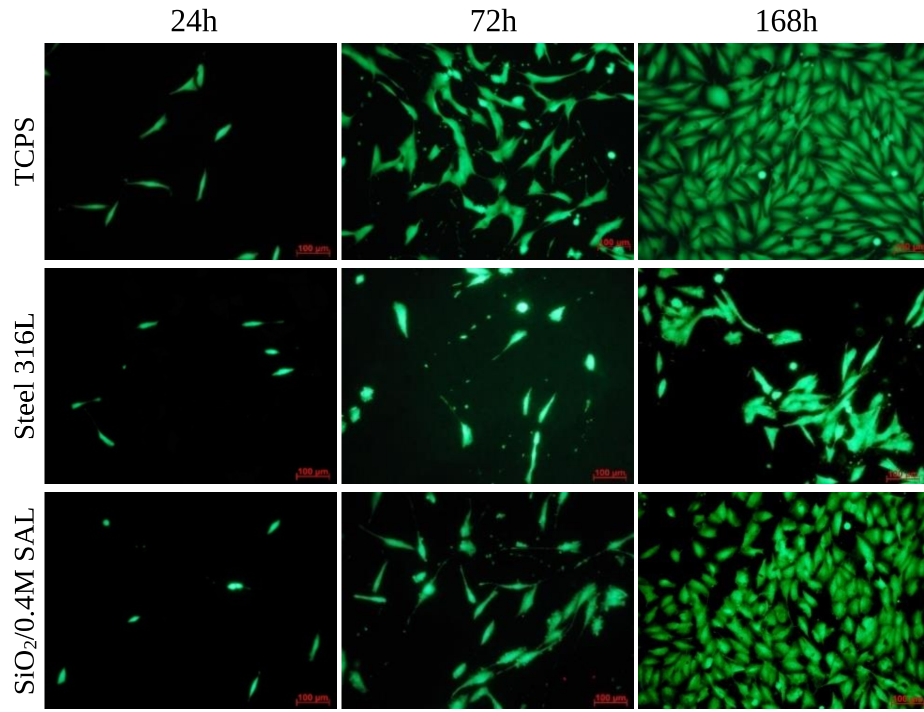
θ_w: water contact angle; θ_{di}: diiodomethane contact angle; SFE: surface free energy, γ_d: dispersive part of SFE; γ_p: polar part of SFE (average standard deviation (SD), n=10).

Results

The polarization curves in Ringer's solution



Live/dead staining using Calcein AM/propidium iodide



Electrochemical analysis implies that obtained **coatings improved corrosion resistance** of the tested biomaterials in Ringer's solution.

Obtained coatings are ***cyto*compatible. Bioactivation** of SiO_2 sol-gel **coatings by active molecules improved cell activity** - increased adhesion and proliferation.

Final remarks

Effective procedure of bioactivation of SiO_2 sol-gel coatings by active molecules has been developed.

Synthesized coatings:

- were **crack free and uniformly covered metallic substrate (~240 nm thick).** Pure SiO_2 thin films were more smooth, while SiO_2/active substance coatings presented different - specified surface morphology;
- **changed surface topography** - increased roughness;
- active **dopants decreased θ_w** and enhanced hydrophilicity of basic SiO_2 coatings;
- **improved corrosion resistance** - increased polarization resistance (R_p) and decreased corrosion current density (i_{CORR}) of AISI 316L substrate;
- were **cytocompatible** and additionally, the **active dopants promoted cell activity.**

POSTER No 298

27th European Conference on Biomaterials

30 August - 3 September 2015, Kraków, POLAND

Wrocław University of Technology

Silica Particles for the Design of Smart Delivery Nanotools

Rafał Mech, Beata Borak, Katarzyna Łuszczyk, Daniel Lewandowski Agnieszka Baszczuk, Marek Jasiorski, Jerzy Kaleta

Department of Mechanics, Materials Science and Engineering, Wrocław University of Technology,

Smoluchowskiego 25 str. 50-370 Wrocław, POLAND

beata.borak@pwr.edu.pl

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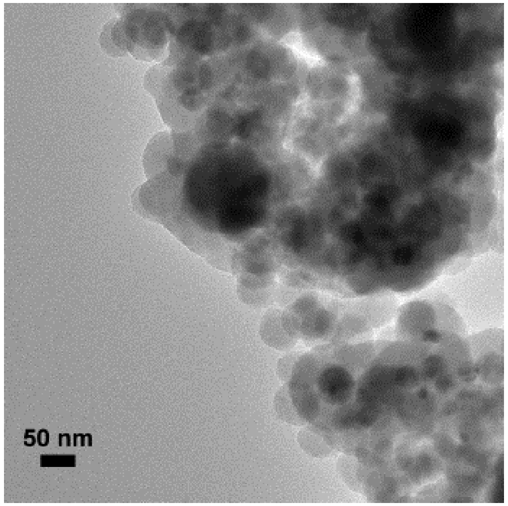
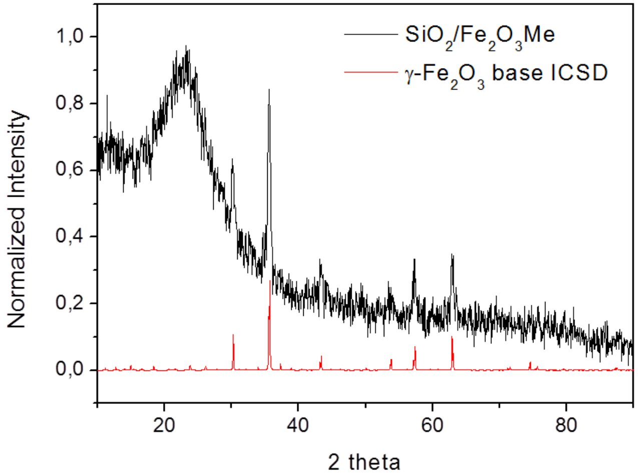
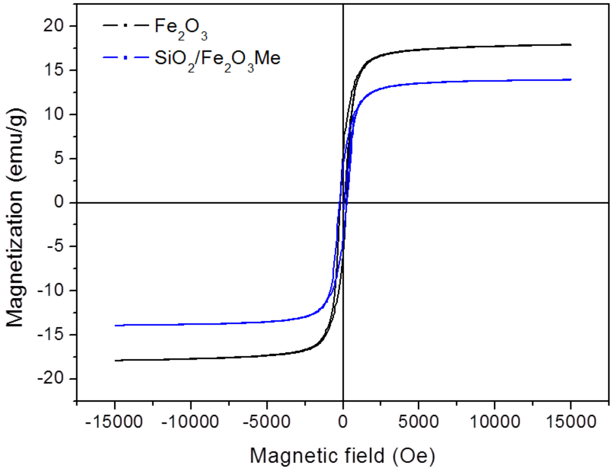


SiO_2/Fe_2O_3 particles.



XRD pattern of the SiO2/Fe_2O_3 particles.



Room temperature M-H loops of the Fe_2O_3 and SiO_2/Fe_2O_3 particles.

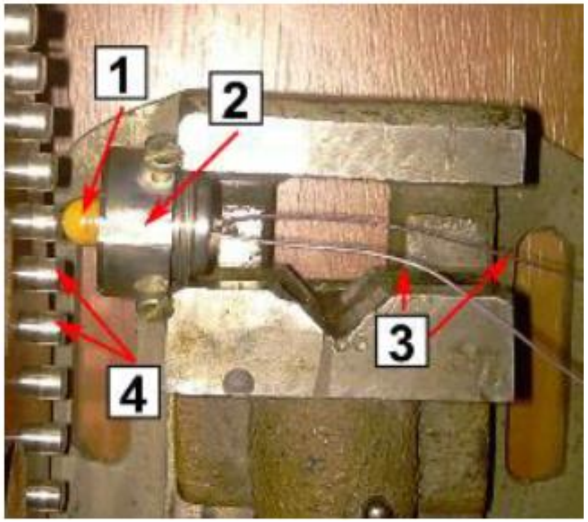
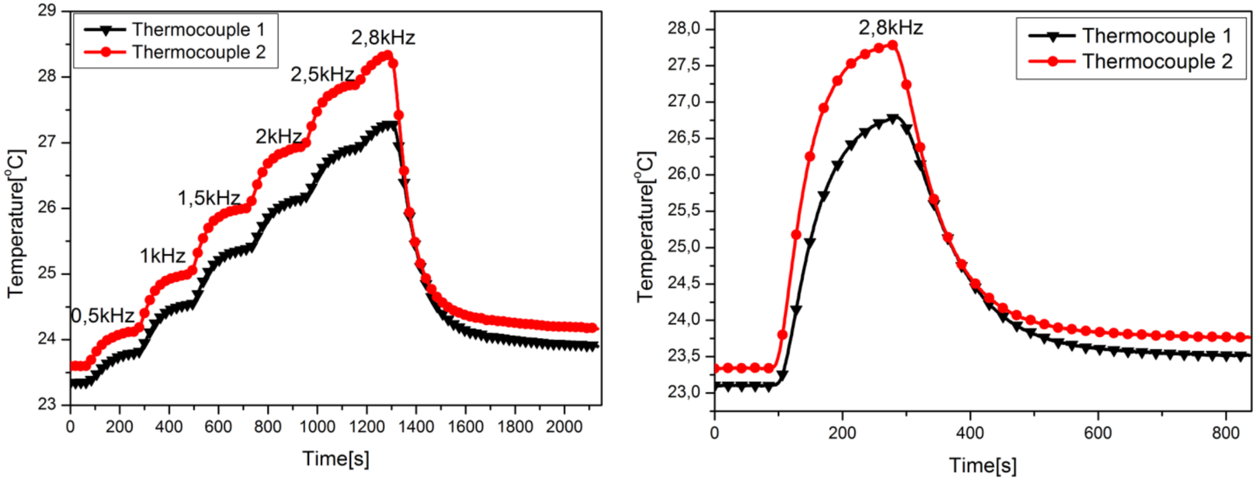


Diagram of the measuring position.



Temperature change of magnetic particles measured with use of thermocouples a) for different frequencies of magnetic field changes, b) for maximum frequency of magnetic field changes.

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Silica nanoparticles stability in model biological media

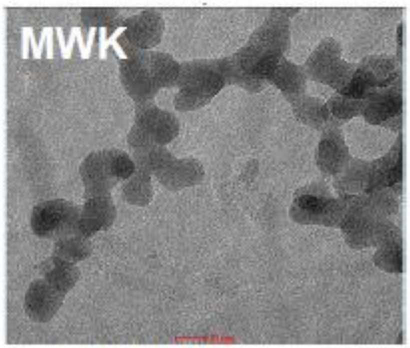
Beata Borak[1], Błażej Poźniak[2], Rafał Wiglusz[3], Robert Pązik[3]

[1]Chair and Department of Pharmaceutical Technology, Wroclaw University of Technology, Smoluchowskiego 25, 50-370 Wroclaw Poland

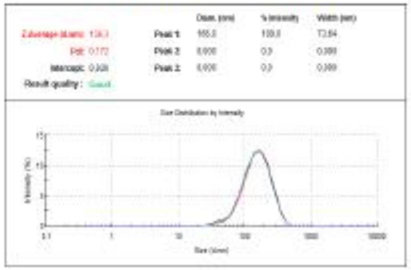
[2]Department of Biochemistry, Pharmacology and Toxicology, Faculty of Veterinary Medicine, Wrocław University of Environmental and Life Sciences, POLAND

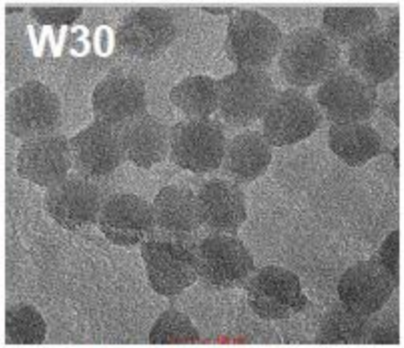
[3]Institute of Low Temperature and Structure Research, Polish Academy of Science, Wrocław, POLAND

Silica nanoparticles characteristics

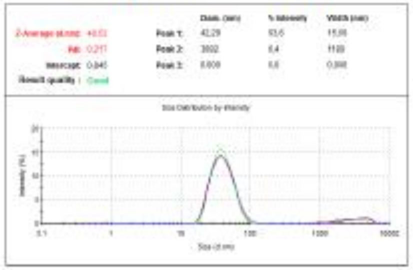


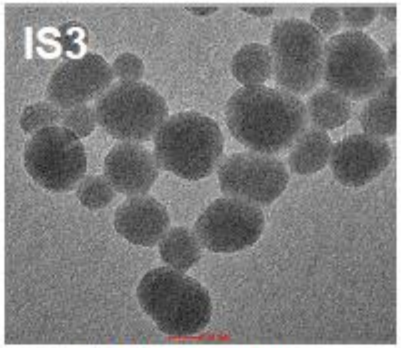
TEM Ø 30 nm
Zeta potential: -45 mV



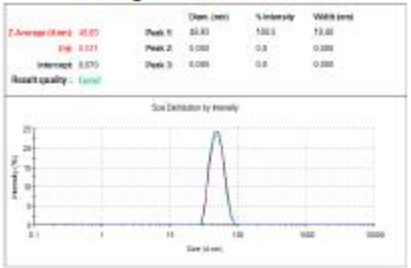


TEM Ø 20-25 nm
Zeta potential: -45 mV

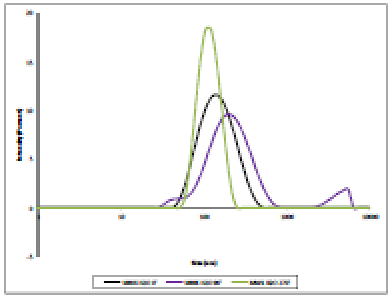


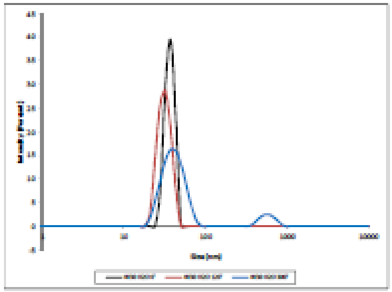


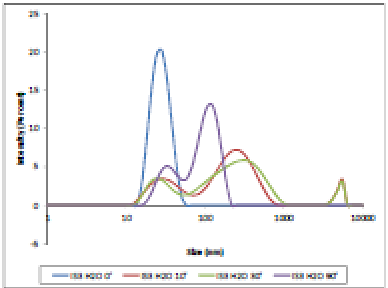
TEM Ø 20-40 nm
Zeta potential: -32 mV



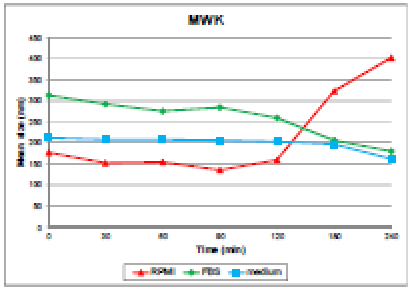
Stability of silica nanoparticles in water

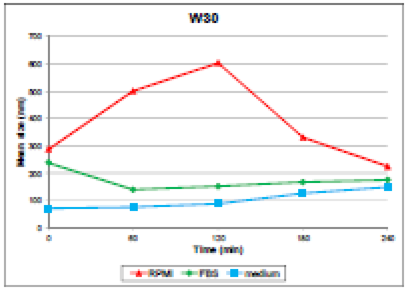


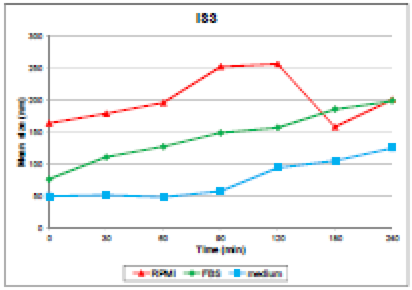




Stability of the silica nanoparticles in different biological media (100 µg SiO_2 nanoparticles/1 ml medium)







NANO
CONFERENCE
2015

7 KRAJOWA KONFERENCJA NANOTECHNOLOGII

7TH POLISH CONFERENCE ON NANOTECHNOLOGY

24TH-27TH JUNE 2015

POZNAŃ, POLAND

Size-dependent cytotoxicity of silica nanoparticles in a macrophage in vitro model using a non-colorimetric assay

B. Poźniak[1], **B. Borak**[2]

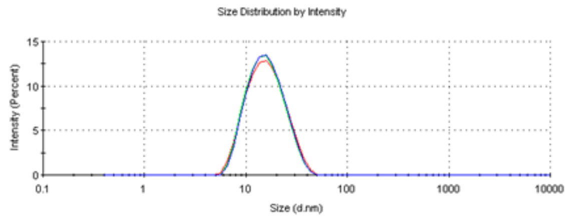
[1]Department of Biochemistry, Pharmacology and Toxicology, Faculty of Veterinary Medicine
Wrocław University of Environmental and Life Sciences
[2]Department of Mechanics, Materials Science and Engineering,
Wroclaw University of Technology

Corresponding e-mail: blazej.pozniak@up.wroc.pl

UNIVERSITAS RERUM NATURALIUM WRATISLAVIENSIS

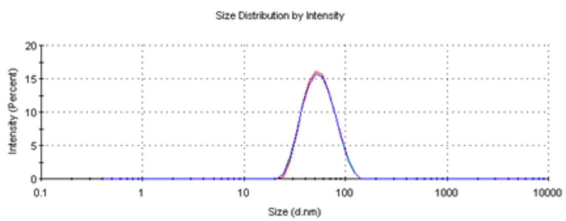
SN1

			Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm):	14,36	Peak 1:	16,92	100,0	7,250
PdI:	0,153	Peak 2:	0,000	0,0	0,000
Intercept:	0,959	Peak 3:	0,000	0,0	0,000
Result quality :	Good				



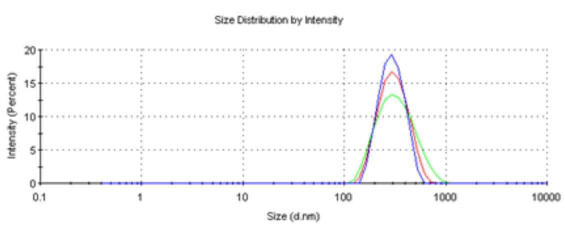
SN2

			Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm):	52,49	Peak 1:	57,29	100,0	19,31
PdI:	0,131	Peak 2:	0,000	0,0	0,000
Intercept:	0,966	Peak 3:	0,000	0,0	0,000
Result quality :	Good				

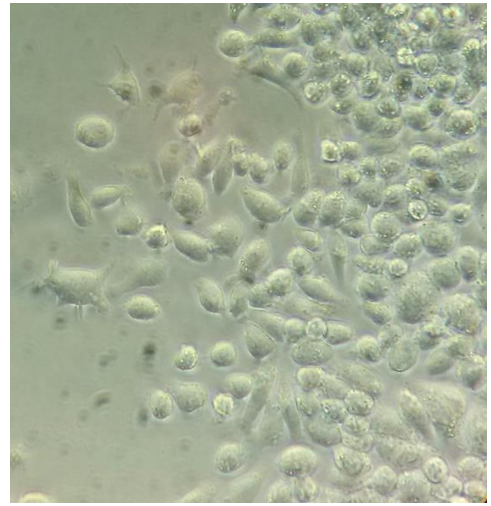


SN3

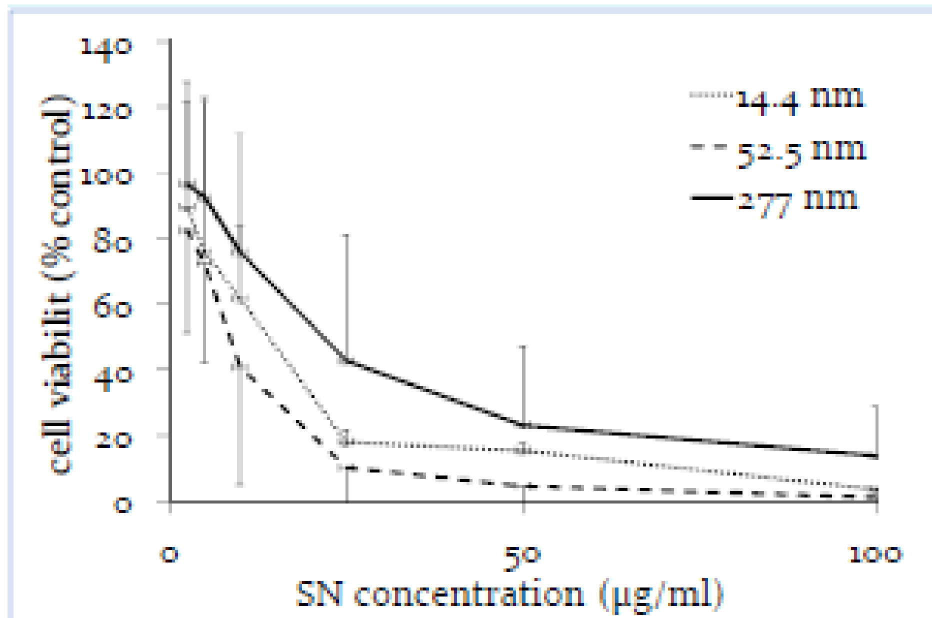
			Size (d.nm):	% Intensity:	St Dev (d.nm):
Z-Average (d.nm):	277,3	Peak 1:	316,4	100,0	102,3
PdI:	0,136	Peak 2:	0,000	0,0	0,000
Intercept:	0,957	Peak 3:	0,000	0,0	0,000
Result quality :	Good				



Dynamic light scattering technique revealed following hydrodynamic sizes: SN1 – 14.4 nm, SN2 – 52.5 nm and SN3 – 277 nm.



Murine macrophage-derived cell line (J774.E)



Dose-dependent cytotoxicity of silica nanoparticles to J774.E cells after 72 h of incubation.

Wrocław University of Technology

Sol-Gel 2015

Kyoto, Japan September 6 – 11, 2015

Luminescent spherical particles of SiO_2-CaO glass prepared by sol-gel method

Anna Lukowiak[1], Justyna Krzak[2], Beata Borak[2], Jean-Marie Nedelec[3]

[1] Institute of Low Temperature and Structure Research PAS, 2 Okolna St., 50-422 Wroclaw, Poland
[2] Department of Mechanics, Materials Science and Engineering, Wroclaw University of Technology, 25 Smoluchowskiego St., 50-370 Wroclaw, Poland
[3] ICCF, CNRS UMR 6296, ENSCCF, BP 10448, 63177 Clermont-Ferrand, France

justyna.krzak@pwr.edu.pl

XVIII International Sol-Gel Conference Kyoto
Sol-Gel 2015
Kyoto, Japan September 6 – 11, 2015

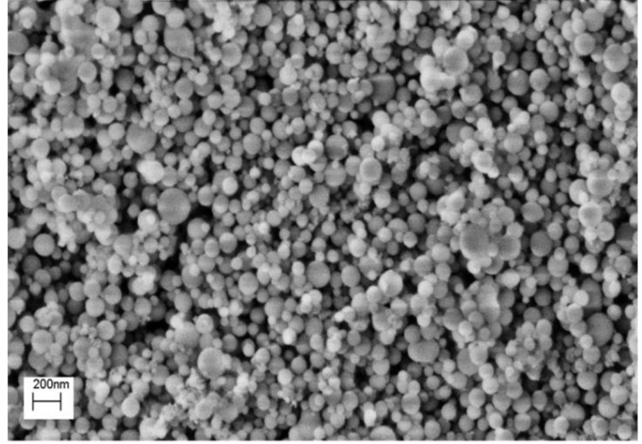


Figure 1. SEM picture of Eu^{3+}-doped BGl-800 particles.

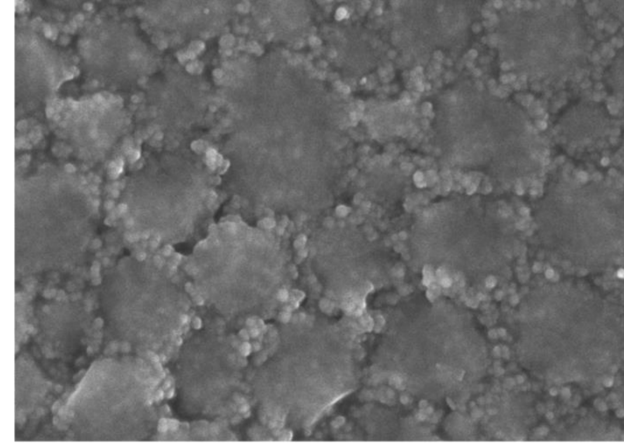


Figure 2. SEM picture of Eu^{3+}-doped BGl-600 particles.

X-ray diffraction

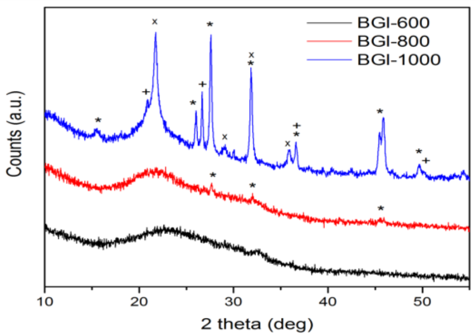


Fig. 3. XRD patterns of glass particles annealed at different temperaturę.
(*) pseudowollastonite,
(x) cristobalite, (+) quartz

Raman spectroscopy

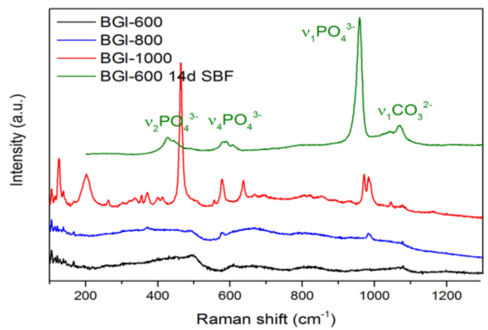


Fig. 4. Raman spectra of the glasse sintered in different temperature

Photoluminescence spectroscopy

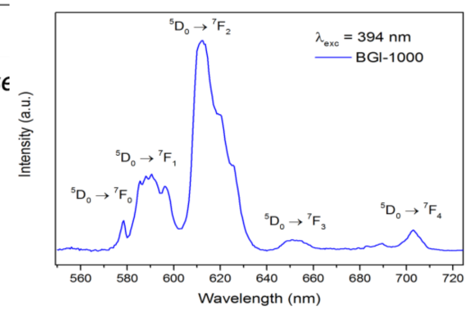


Fig. 6. Luminescence spectrum of Eu^{3+} ions under 394 nm excitation for powder annealed at 1000°C.

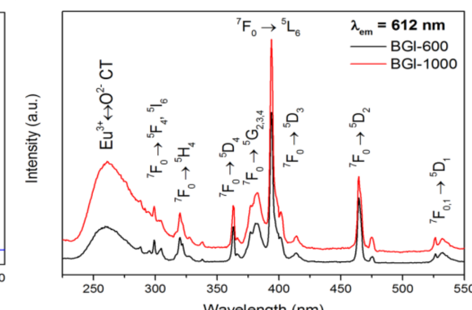


Fig. 7. Luminescence excitation spectra registered for emission at 612 nm.

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