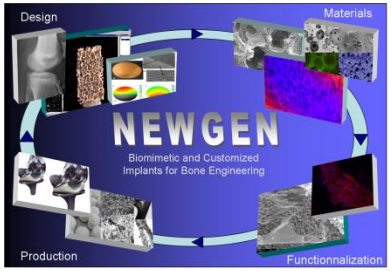
CEITEC/Central European Institute of Technology BUT

GENERAL PRESENTATION

- **Complete denomination**: Brno University of Technology,
  Central European Institute of Technology
- **Location (city, country)**: Brno, Czech Republic
  Technicka 10, 61600 Brno, CR
- **Director**: Prof. Radimir Vrba
- **Contact person in NEWGEN**: Prof. Jaroslav Cihlar; cihlar@fme.vutbr.cz



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BRNO | CZECH REPUBLIC

CEITEC: was found by the European Commission in 2011. It is a consortium of 4 universities and 2 research institutes located in Brno. 7 research programmes (composed of 60 research groups) of CEITEC integrate R&D in the fields of life sciences, advanced materials and nanotechnologies .

Research Programm Coordinator of Advanced Materials:

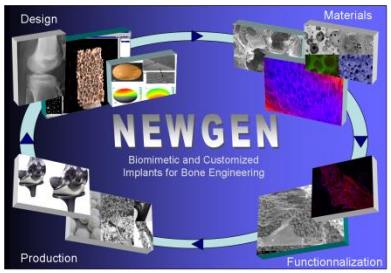
Prof. Jaroslav Cihlar

Researchers of Advanced Ceramic Materials RG:

4 Profs, 2 Assoc. prof, 3 senior researchers, 5 junior researchers, 6 PhD students, 6 temporary researchers

Researchers of BioCeramics Unit (involved in NEWGEN):

1 Prof, 1 Assoc. prof, 1 senior researcher,
3 junior researchers, 3 PhD students



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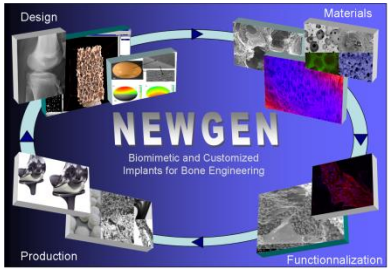
RESEARCHERS EXPERTISES

- non-classical and colloidal synthesis of bioceramic nanoparticles;
- morphology and structure of bioceramic nanoparticles and composites;
- technology of advanced (bio)ceramic materials (electrophoretic deposition, powder injection moulding, pressing, CIP, HIP, dip-coating, spraying, sol-gel methods);
- physical and chemical processes in bioceramic materials;
- physical, mechanical and biological properties of advanced bioceramics and composites



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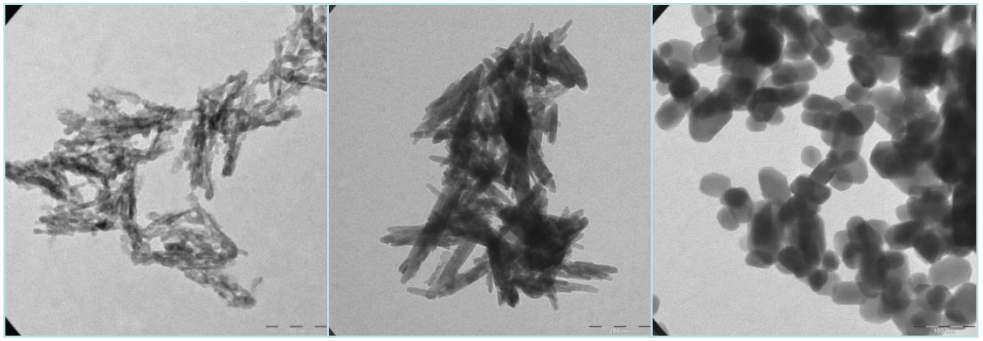
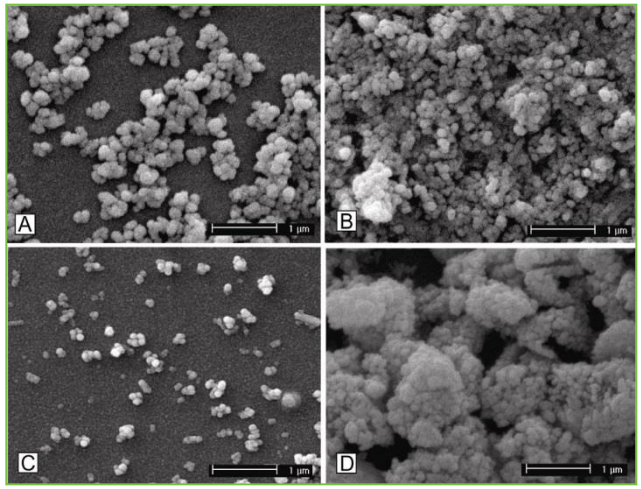
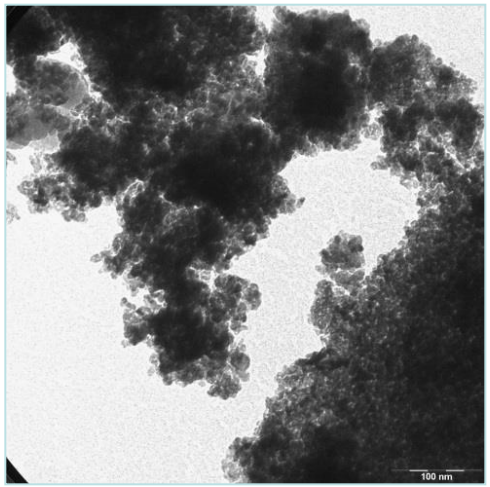
Synthesis of nanoparticles and precursors

Morphology of hydroxyapatite nanoparticles prepared by hydrothermal synthesis

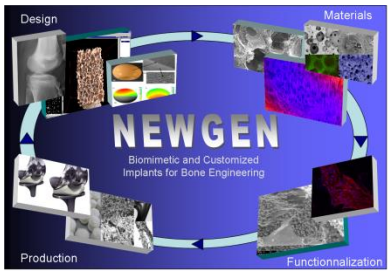


Hydroxyapatite nanoparticles prepared by solvothermal sol-gel synthesis from alkylphosphoric acids





Calcium stabilised zirconia nanoparticles prepared by sol-gel synthesis



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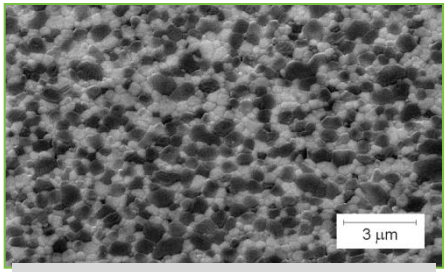
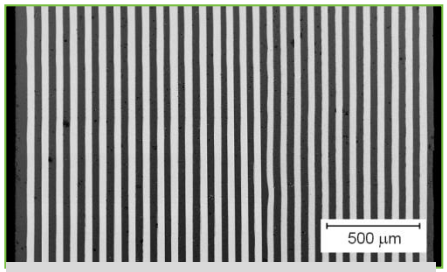
Bioceramic composites and scafolds

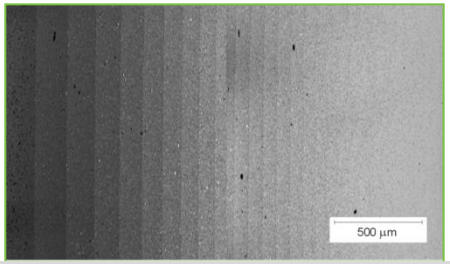
Zirconia/alumina and zirconia/hydroxyapatite composites prepared by electrophoretic deposition



particle composite



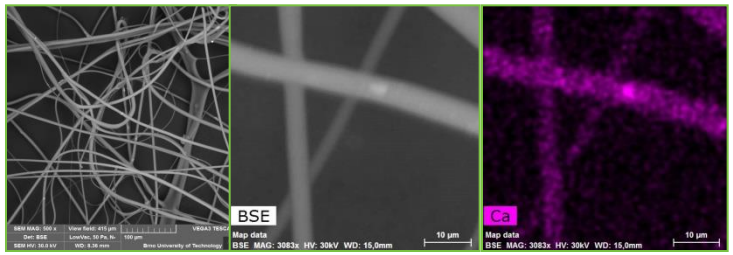
layered composite

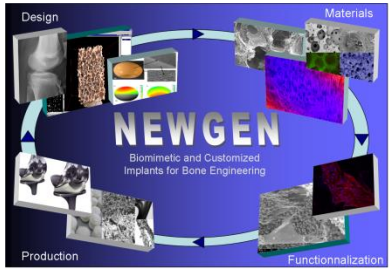


concentration graded composite

Hydroxyapatite scaffold prepared by template method

Chitosan/hydroxyapatite composite nanofibres prepared by force-spinning





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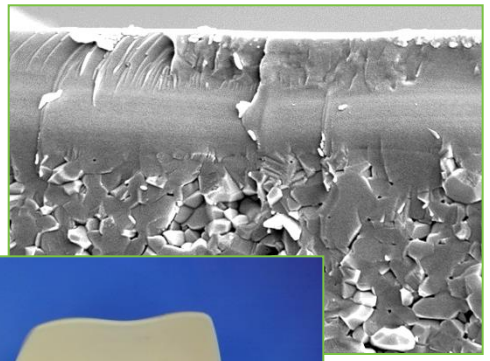
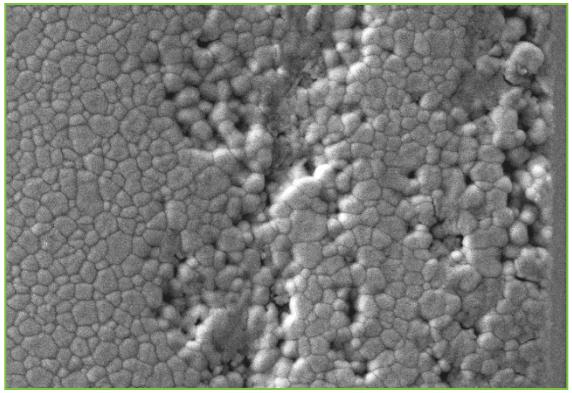
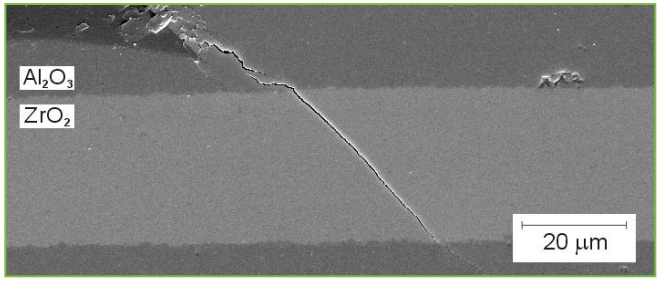
Bioinert bioceramic composites

Hydroxyapatite coating on the surface of zirconia knee implant component

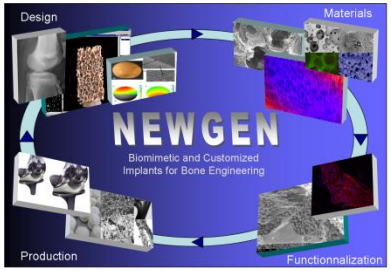




Corrosion of zirconia knee implant surface by water steam



High fracture toughness layered zirconia-alumina composites



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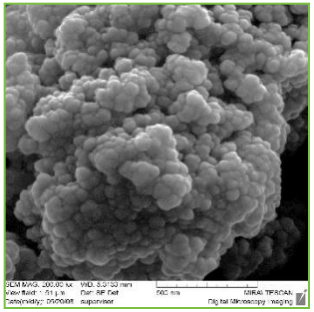
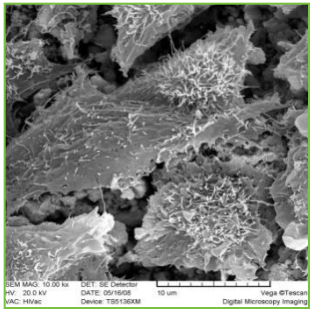
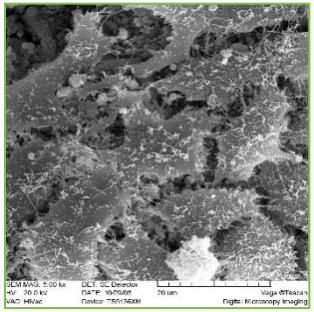
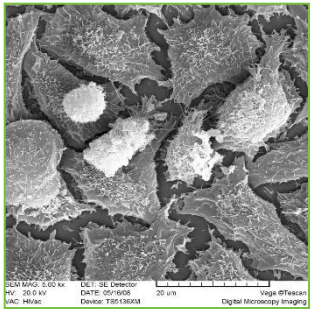
Cytocompatibility of bioceramic composites

Spreading of cells on the surface of zirconia nanostructured coating

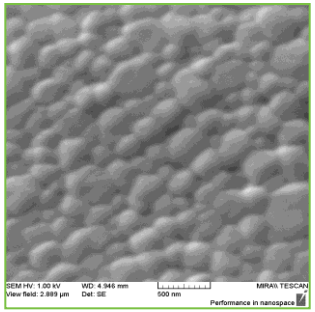
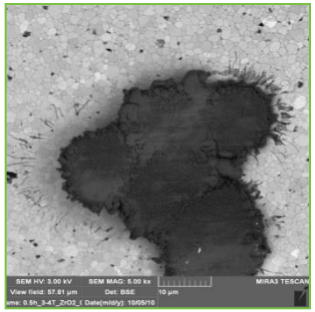
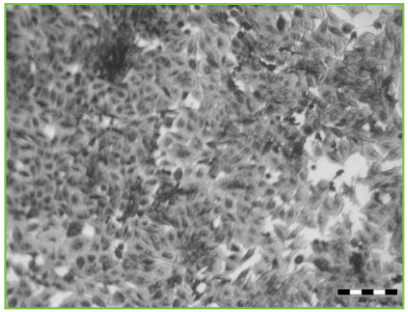
(72 hours of cultivation)

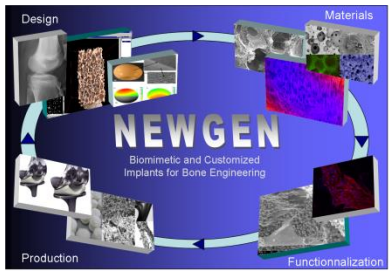
epithelic cells-HeLa fibroblastic cells-L929 osteoblastic cells-MG63

Spreading of cells on the surface of polished zirconia nanograined surface

(0.5 and 2 hours of cultivation)

osteoblastic cells-MG63



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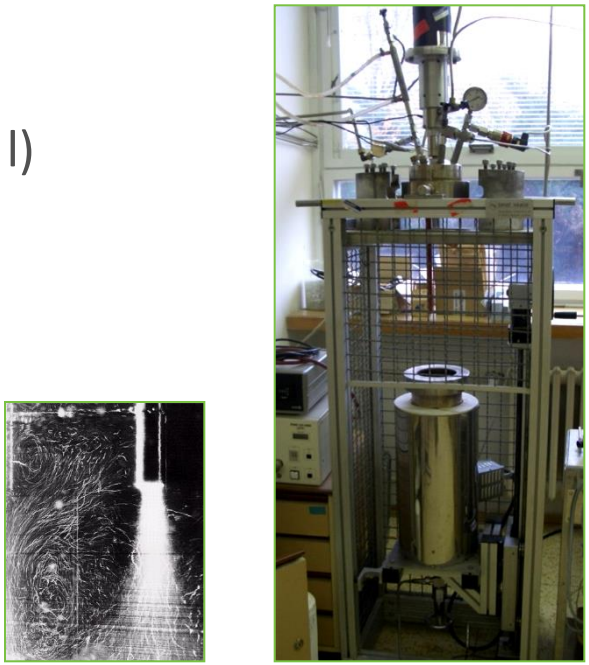
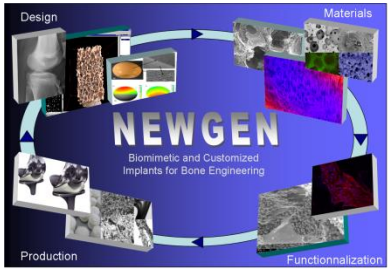
Synthesis of nanoparticles and precursors

- solvothermal reactor (250°C, 20 MPa, 5 l)
- microwave solvothermal reactors (200°C, 10 MPa, 1 l)
- ultrasonic sonochemical reactors
- spray dryers
- high temperature solid state reactors



Characterisation of nanoparticles and precursors

- **physical**: gran size distribution, surface area, zeta potential, morphology (TA, DSC,.)
- **chemical and structural**: IR, UV, Raman, MNR, XRD, SEM, TEM, HRTEM, AFM, XPS, EDS,…….
- **biological**: cell culture, cytocompatibility, biochemistry, microbiology



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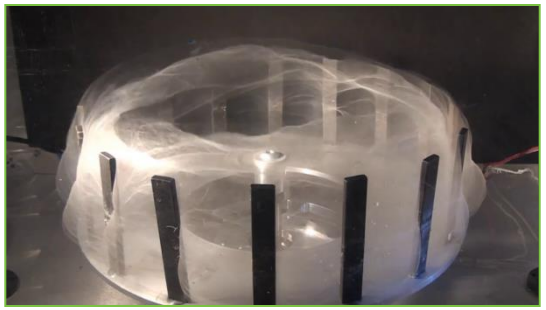
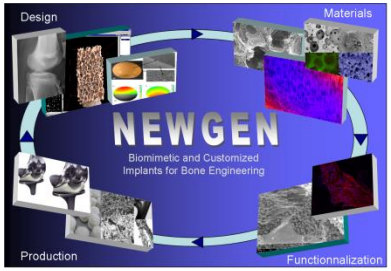
Consolidation and Shaping

- uniaxial pressing, CIP, HIP,
- slip casting, tape casting, machining, atritors
- dip-coating, spray coating, jet-printing
- 3D ceramic lithography
- force-nanospinning

Binder extraction and Densification

- temporary binders extractors
- pressureless sintering at various atmosheres
- HIP





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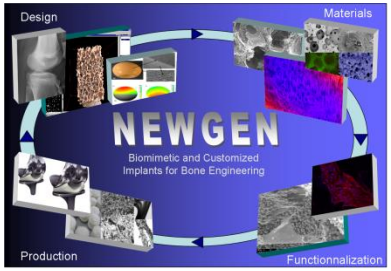
Characterisation of bioceramics, coatings and fibres

- **physical**: density, pore distribution, porosity,
- **microstructure**: complete ceramography, XRD, IP, Raman, SEM, TEM, HRTEM, AFM, XPS, EDS,.
- **mechanical properties**: flectural and compresive strength, fracture toughness, hardness, surface roughness
- **electrical properties:** impedance spectroscopy, piezoelectricity, …….
- **biological**: cytocompatibility, biochemistry, microbiology



THE GOALS IN NEWGEN

- The research of CEITEC-BUT group could be primarily focused on structurally and functionally graded composites and multiphase scaffolds based on hydroxyapatite, non-stoichiometric Ca-phosphates, Ca-phosphate substituted by biogenic elements, and bioactive polymer carriers of Ca-phosphate nanoparticles stimulating an osteoinduction of bone cells.
- Biomaterial research will include a study of the synthesis of multiphase Ca-phosphate nanoparticles and bioactive polymers and the study of the manufacture, structure and properties of new (nano)bioceramic composites and scaffolds.
- 3D printing of bioceramic and composite scaffolds , force-spinning of biopolymer/Ca-phosphate nanofibres (scaffolds) and EPD/template methods will be namely investigated.