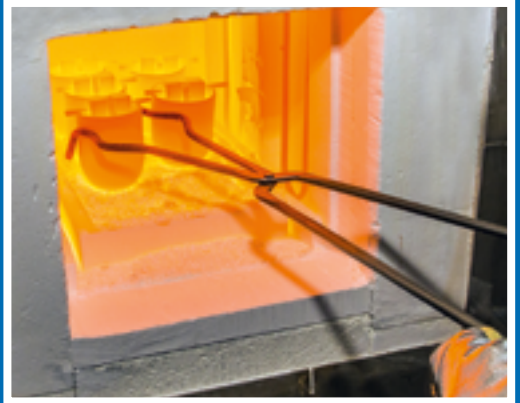
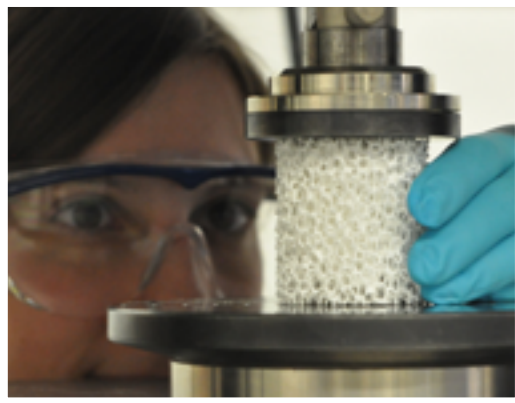




TECHNISCHE UNIVERSITÄT
BERGAKADEMIE FREIBERG

Die Ressourcenuniversität. Seit 1765.



INSTITUTE OF CERAMIC, GLASS AND
CONSTRUCTION MATERIALS

MAIN RESEARCH

Ceramics

- Development of thermal shock and corrosion resistant ceramic materials for high-temperature applications in the metallurgy, cement and glass industry (carbon-containing ceramics, castables for furnace lining, thermal shock resistant ceramics for steel, titanium, silicon and aluminum metallurgy)
- Porous ceramics for high-temperature applications (molten metal filters, insulating materials)
- Alkali-resistant insulating materials
- Refractory composite materials
- Metal-ceramics composite materials
- Ceramic process engineering (additive manufacturing, pressure slip casting, pulsating CIP, extrusion, flame spraying, electrospinning, shotcreting)
- Development of environmentally friendly binder systems for refractory applications
- Material and component testing for ambient and high temperature applications
- Development of self-healing materials and refractory products with extended durability
- Development of inorganic non-metallic materials with reduced emissions throughout the production and application

Glass and Enamel Technology

Technology-oriented and industry-related research, development and consulting:

- Optimisation and stabilisation of manufacturing processes (batch, melting, forming, annealing, tempering technologies)
- Finishing of flat glass and container glass
- Improvement of vitreous surfaces
- Sustainable utilisation of glasses in high-technologies
- Recycling of waste glasses and other mineral residuals
- Colour analysis and colouring process
- Vitreous enamels and enamelling technology
- Manufacturing technology of foam glass

Construction Materials Technology

- Dry mortar technology and development of composite materials based on ternary binders and polymer powders
- Self-compacting concrete
- Usage of secondary raw materials in concrete technology
- Development and characterization of novel binder systems
- Durability of concretes and mortars
- Microstructure of cement based materials
- Rheology of cementitious materials
- Early shrinkage of concrete and complex mortars
- Water vapor and nitrogen adsorption in porous materials

RESEARCH PROJECTS



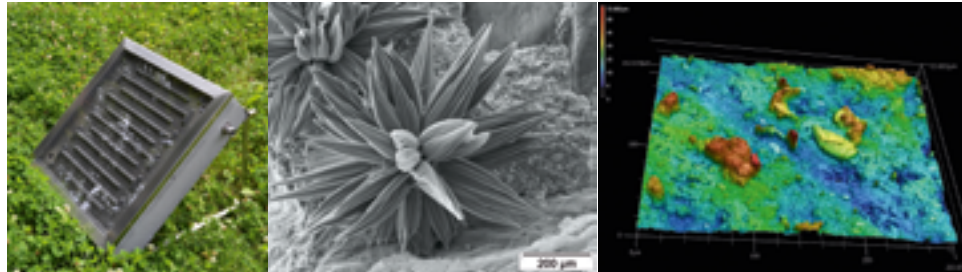
Ceramics

- Multi-functional Filters for Metal Melt Filtration – A Contribution towards Zero Defect Materials (Collaborative Research Center CRC 920)
- TRIP-Matrix-Composite – Design of tough and transformation toughened composite materials and structures based on Fe-ZrO₂ (Collaborative Research Center CRC 799)
- Aqueous pressure slip casting of coarse-grained, carbon-containing refractory materials (DFG project AN 322/31-1)
- Innovative refractory and induction melting systems for titanium and titanium alloys (DFG transfer project AN 322/32-1)
- Development of a tubular vapor electrolyzer with integrated hydrocarbon synthesis (DELTA); Sub-project: Material development of proton conducting solid electrolyte (SAB project 100251210)
- Development of an alkali metal converter for the high-efficient direct conversion of heat into electrical current (AMTEC-D); Sub-project: An alternative system to alkali permeable membranes based on sodium titanates (SAB project 100240824)
- Continuous near-net-shape manufacturing of complex key components for high-temperature applications based on coarse-grained refractory materials by means of pressure slip casting – KontinenD (BMBF project 03VP00060)
- FinAlGuss – Innovative contributions to the corrosion resistance of carbon-containing calcium silicates based functional materials for the casting of aluminum alloys (BMBF project 03XP0022C)
- Joint research project Alu-Network: Raising efficiency of aluminum furnaces by the application of metal-ceramic composites; Sub-project: Material and manufacturing technology (BMW i project 03ET1393B)
- KORRISTENT – Corrosion and slagging lean operation of brown coal boilers (BMW i project 03ET7066A)
- Improvement of the thermal shock resistance of refractory ceramic materials by the development of new exemplary material systems (AiF project 18732 BG)
- Casting of high reactive titanium alloys (IGF project 18598 BG)
- Hybrid technologies and materials for the manufacturing of casting molds and crucibles to investment casting of high melting and high reactive alloys (IGF project 18293 BG)
- Development and characterization of Al₂O₃-C materials with nanoscaled additives (ZIM project ZF 4096901SU5)
- Development of a ceramic coating slip for the production process of larger near-net-shape stainless steel cast components with low surface roughness via different model types with backfilling in the ceramic sandcasting (ZIM project ZF 4096908AG7)



Glass and Enamel Technology

- Process and product development of high insulating, thin, cost-efficient evacuated structural elements for diverse applications – FiberVIP (SAB FiberVIP 100310717)
- Technology for the production of an innovative, alkali-resistant foam glass from previously un-exploitable waste materials from glass recycling (ZIM ZF 4096905CK6)
- Indumail – Development and modelling of local enamel repair (ZIM ZF 4096911AG7)
- Online regeneration to deplete sodium in potassium nitrate melts (ZIM ZF 4096907SL6)
- SolarBend – Curved laminated glass elements with integrated switchable functions and solar power generation (ZIM ZF 4096906AG6)
- Vlsus3D - Process and product development for lightweight, cost-effective, sustainable, fire-proof and load-bearing vacuum-insulated components with foam glass core for various applications (ZIM ZF 4096904WZ6)
- Rapidzem – Development of hydraulically bonded foundry mould materials for hand-moulded iron castings (DBU-AZ 33450)
- Spent foundry sand – Application of spent foundry sand for production of colored container glass (DBU 34046/01-21/2)



Construction Materials Technology

- Micromechanical modelling of drying shrinkage of hardened cement paste based on the pore size distribution and the capillary forces (DFG)
- DAAD Research cooperation with NUST (Pakistan) – Self-compacting pastes using superabsorbent polymers (DAAD)
- Development and optimization of SLU (UBE Industries, Japan)
- Organic-mineral composite materials (industrial project)
- Surface refinement of organic substrates with chemically bonded ceramic layers (industrial project)
- Automated optical data acquisition for workability and shrinkage behaviour of mortars and pastes (DFG/DAAD)
- Coating of raw materials for novel geopolymers (DAAD)
- Quantitative determination of amorphous hydrate phases by XRD
- Factor analysis of data (Big Data) from XRD

COLLABORATIVE RESEARCH CENTER CRC 920

Multi-functional Filters for Metal Melt Filtration – A Contribution towards Zero Defect Materials



Planned program period: 2011–2023

Coordinator:

Prof. Dr.-Ing. habil. Christos G. Aneziris, IKGB, TU Bergakademie Freiberg

Deputy Coordinator:

Prof. Dr.-Ing. habil. Horst Biermann, IWT, TU Bergakademie Freiberg

The vision of the collaborative research center CRC 920 is to create a new generation of metal qualities via melt filtration with superior and adaptive mechanical properties for the use in light-weight structures and high demand construction materials. The development of novel **intelligent filter materials and systems** for the filtration of endogenous and exogenous inclusions from metal melts and a model-supported filter design enable the manufacturing of thin- as well as thick-walled highly demandable components based on steel, iron, aluminum and magnesium with outstanding properties for the applications in transportation, electronics industry, aeronautical and medical engineering.

→ www.sfb920.tu-freiberg.de

COLLABORATIVE RESEARCH CENTER CRC 799

Design of tough, transformation-strengthened composites and structures based on Fe-ZrO₂



Planned program period: 2008–2020

Coordinator:

Prof. Dr.-Ing. habil. Horst Biermann, IWT, TU Bergakademie Freiberg

Deputy Coordinator:

Prof. Dr.-Ing. habil. Christos G. Aneziris, IKGB, TU Bergakademie Freiberg

The aim of the collaborative research center CRC 799 is the exploration of a new class of high-performance composites called **TRIP-MATRIX-COMPOSITES** based on TRIP-assisted steels and zirconium dioxide ceramics (TRIP: transformation-induced plasticity). The development of innovative materials, structures, and processes, as well as the application of bionic principles to micro and macro structures, enable the generation of high-performance, highly stressable components with pioneering characteristics for the passenger safety in cars, trains, and aircraft.

→ www.sfb799.tu-freiberg.de



EQUIPMENT

Analytics

- ESEM/EDX, SEM/EBSD, ASPEX
- X-ray diffractometry
- Microfocus X-ray tomography
- UV-VIS spectrometry
- ICP-OES
- Spark spectrometry for Fe and Al
- Helium pycnometry
- Laser granulometry
- Mercury intrusion porosimetry
- Sorption measurements with H₂O and N₂ as adsorptive

Thermal analytics

- DTA/TG, DSC
- Calorimetry
- Dilatometry up to 1500 °C
- Hot stage microscopy up to 1500 °C

Testing equipment

- Hood-type furnace up to 1650 °C (refractoriness under load, creep in compression, thermal expansion)
- Testing equipment for determination of modulus of rupture at elevated temperatures up to 1400 °C
- Testing equipment for determination of thermal conductivity up to 1200 °C
- Corrosion testing furnace up to 1600 °C
- Rheometer up to 200 °C/45 bar (incl. oscillation and multiwave measurements)
- Equipment for testing of green and hardened mortars and concrete
- Freeze-thaw/deicing-salt-attack resistance of mortars and concrete by CIF/CDF
- Shrinkage channel (Early shrinkage measurements of pastes and mortars)
- Testing equipment for determination of transmission, reflexion, index of whiteness, chromaticity coordinate, chemical resistance, viscometric fixed points of glasses, enamels, and glazes
- Ultrasonic technique for non-destructive testing
- Testing equipment for determination of the hot modulus of elasticity up to 1600 °C
- Strength testing machines (10 N to 4000 kN)

Pilot equipment

- Metal casting simulator
- 3D printing devices
- Electrospinning devices
- Different chamber and tube furnaces up to 1750 °C, partially with adjustable atmosphere
- Gas-fired furnace up to 1100 °C
- Facilities for technology investigations (slip casting, extrusion, pressing)
- Pressure slip casting machine
- Flame spraying unit
- Autoclaves
- Glass melting aggregate GLAWA-1 (with the capacity of 1 t/d) for tests under industrial conditions in pilot scale (rolling machine applicable)
- Equipment for thermal hardening of flat glass

CONTACT PERSONS

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STUDY COURSE GUIDE AND INFORMATION

- German-language Diploma's degree programme *Ceramic, Glass and Construction Materials* (10 semesters); German-language Master's degree programme *Ceramic, Glass and Construction Materials* (3 semesters)
Contact person: **Dipl.-Ing. Kathrin Häußler**
Tel.: 03731 39-3437
kathrin.haeussler@ikgb.tu-freiberg.de
- English-language Master's degree programme *Technology and Application of Inorganic Engineering Materials TAIEM* (4 semesters)
Contact persons: **Prof. Dr.-Ing. habil. Christos G. Aneziris**
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Prof. Dr.-Ing. Olena Volkova
olena.volkova@iest.tu-freiberg.de

Taster courses for prospective students

- MINT-EC-Camps "Future Materials"
- Taster courses "Ceramic, Glass and Construction Materials"
- Taster course "Ceramics meet Steel"
- Night in the Lab "GLASS"
- Night in the Lab "CERAMICS"

For more information please visit → www.ikgb.de



PROFESSORSHIPS

Professorship of ceramics

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