

Evolving the well-established

vdz

**Service
Offer**

Chemistry
and Mineralogy

High-quality services from a single source

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**Synergies from research
and expertise**

With its research institute, VDZ has a renowned and internationally recognised scientific institution which provides industry-oriented research and a comprehensive service portfolio in the field of cement and concrete and has been contributing to the highest possible quality of building materials for more than 140 years.

Our interdisciplinary team provides answers to almost any questions about cement-based building materials according to the current state of science and technology. At the same time we offer our customers a service package that includes all major tests as well as consultancy services and complex expert reports. The combination of current research and competent service leads to synergies which are reflected in the high quality and practical relevance of our work.

In our “Chemistry and Mineralogy” division a team of specialists performs the analysis and characterisation of inorganic mineral materials, raw materials and fuels in cement production and also of cements and their related construction products.

Characterisation of materials

Characterisation of materials

VDZ has a powerful accredited and certified testing laboratory according to EN ISO/IEC 17025, with highly qualified staff and comprehensive technical equipment.

Many substances can therefore be extensively investigated, including:

- Cement (main constituents: Portland cement clinker, granulated blastfurnace slag, pozzolanic materials, trass, fly ash, burnt shale, limestone, silica fume; minor additional constituents; calcium sulfate: gypsum, anhydrite; additives), raw meal, kiln dust, other binders
- Mineral raw materials (e.g. clay, marl) and aggregates (sand, gravel, crushed stone)
- Lime and lime products
- Admixtures and additions for mortar and concrete
- Pigments
- Fossil and alternative fuels

For these substances, extensive and complex physical, chemical and mineralogical analyses are offered.

Physical investigations

Physical investigations

- Bulk density according to EN 459-2
- Water demand according to EN 196-3 or Puntke method
- Water retention capacity according to EN 413-2
- Penetrometer measurements, penetration depth according to EN 413-2 or DIN 4211
- Spread according to DIN 1164/58
- Standard consistency according to EN 413-2, EN 459-2 or ASTM C 185
- Air content in fresh mortar according to EN 459-2
- Setting time according to EN 196-3 or EN 480-2
- Soundness according to EN 196-3, DIN 1164 or ASTM C 151
- Flexural tensile strength and compressive strength according to EN 196-1
- Zeta potential (electro-acoustic spectrometer)
- Thermal analysis – DSC up to 600 °C, TG/DTA (STA) up to 1500 °C
- Net and gross calorific values by combustion calorimetry
- Heat of hydration according to EN 196-11
- Sulfate resistance by the SVA, Wittekind and CEN methods
- Ultra-accelerated mortar bar test on alkali-silica reactivity (ASR) according to the DAfStb Alkali Guideline or LMPA method

**Chemical-mineralogical
investigations**

Chemical investigations

- Standard investigations on cement, clinker and other cement constituents according to EN 196-2
- XRF (X-ray fluorescence) analysis on pressed pellets or fused beads
- Alkalis in concrete admixtures according to EN 480-12
- Chloride in concrete admixtures according to EN 480-10
- Ion chromatography
- Metals, semi-metals (trace element analysis) by AAS or ICP-MS
- Elemental analysis (H, C, N, O, S) according to DIN 51721, DIN 51732, ISO 13878, ISO 20884
- TOC and TC according to EN 13639
- Water-soluble chromate according to EN 196-10 or TRGS 613
- Fluoride, bromine, sulfite
- Aluminium, iron, silicon (photometrically)
- Reactive SiO_2 and CaO
- Pozzolanicity according to EN 196-5
- Cement main constituents according to CEN/TR 196-4
- Fuels – ash according to DIN 51719
- Fuels – volatile constituents according to DIN 51720
- Fuels – alkalis, halogens, sulfur, nitrate according to EN 14582
- Fuels – total carbon according to EN 13639
- Fuels – biogenic content according to EN 15440
- Fuels – water according to Karl Fischer ISO 12937
- Organic components in solids (VOC, VCO, VNOX, CSO₂)
- Organic components by GC-MS or IR spectroscopy
- BTEX analysis according to VDI 2100, sheet 2
- PCB, BTEX, PCP, PAH

Mineralogical investigations

- Methylene blue test
- Granulated blastfurnace slag content by counting
- Petrography of aggregates
- Scanning electron microscopy (SEM) and microanalysis (EDX)
- Qualitative and quantitative X-ray diffraction (XRD), Rietveld refinement

**Consulting, product optimisation,
damage analysis and expert reports**

Consulting service and product optimisation

VDZ advises on issues related to product optimisation. Customers benefit in particular from our long-standing expert knowledge, our wide range of services and our modern extensive equipment. We develop suitable, practical solutions in the following fields:

- Characterisation of Portland cement clinker (influence of burning and cooling conditions and of alternative raw materials and fuels)
- Causes of the formation of coating in cement and lime kilns
- Sulfate optimisation of cements (setting characteristics / strengths / interactions with admixtures)
- Performance of chromate reducers
- Characterisation of new binders
- Performance of individual cement constituents
- Hydration characteristics of cementitious binders
- Mode of action of concrete admixtures
- Hygienic properties of cementitious construction materials (e.g. in the drinking water sector)
- Approval procedure for sulfate resisting cements (SR cements)

Damage analysis and expert reports

Our experienced interdisciplinary team of chemists, mineralogists, geologists, physicists and engineers can advise in cases of claims, e.g. cracking or discoloration of concrete surfaces. We provide competent support in determining the causes of damage and compile expert reports.

Efficient procedures are available to investigate damaged samples:

- Qualitative and quantitative X-ray diffraction (XRD)
- Optical microscope analysis of the microstructure in thin sections
- Scanning electron microscope analysis of the microstructure
- Phase determination by thermal analysis

Technical equipment

Microscopy

- Reflected-light and transmitted-light microscope
 - Scanning electron microscope (SEM)
-

Thermal analysis methods

- Differential scanning calorimeter (DSC)
 - Simultaneous thermal analyser (DTA/TG)
-

Determination of the heat of hydration

- Isothermal conduction calorimeter
 - Semi-adiabatic method
-

Determination of the calorific value

- Bomb calorimeter
-

X-ray analysis

- X-ray diffractometer
 - X-ray fluorescence spectrometer
-

Trace analysis

- Atomic absorption spectrometer (AAS)
 - Flow-injection cold vapour AAS (FI-CV-AAS)
 - ICP mass spectrometer (ICP-MS)
-

Chromatography

- Ion chromatograph
 - Gas chromatograph
 - Gas chromatograph with mass-selective detector
 - High-performance liquid chromatograph (HPLC)
-

Molecular spectroscopy

- UV/VIS spectrometer
 - R spectrometer
-

Other

- Zeta-potential analyser

Quality assurance

Quality assurance

The technical equipment for VDZ's and the Research Institute's work is continually adapted to the current state of the art.

In many cases we develop and refine appropriate analytical methods. This makes it possible to respond to individual requirements for chemical-mineralogical and physical-mechanical testing.

A laboratory information and management system enables a high transparency of the processes in the various departments of the institute as well as fast and efficient sample tracking.

VDZ Technology gGmbH is certified according to ISO 9001 by DQS.

VDZ Technology gGmbH is accredited according to ISO 17025 by DAkkS.



Contact



Chemistry and mineralogy

joerg.rickert@vdz-online.de

T +49 (0)211 45 78 233

F +49 (0)211 45 78 444 27

Imprint

Publisher:

VDZ Technology gGmbH
P.O. Box 30 10 63, 40410 Duesseldorf,
Germany
Toulouser Allee 71, 40476 Duesseldorf,
Germany
T +49 (0)211 45 78 0
F +49 (0)211 45 78 296
vdz@vdz-online.de
www.vdz-online.de

Design:

arndtttheunissen GmbH, Duesseldorf

Layout:

Verlag Bau+Technik GmbH, Erkrath

Print:

SGV Reprostudio GmbH, Hilden

Photo credits:

Julia Vogel

Duesseldorf, August 2020

VDZ Technology gGmbH

Toulouser Allee 71
40476 Duesseldorf, Germany

www.vdz-online.de