A Selection of DIFK GmbH Testing Methods

Physical Tests

Corrosion Tests

- Bethlehem- / Hoeganaes Test
- CIREP Test
- H_2 / C-H-N-O-Gas Mixtures Corrosion Test
- CO-Resistance Test
- Induction Furnace Test
- ALCOA Immersion Test
- Rotary Kiln Test
- Cup Test
- Finger Test

Tests at High Temperature

- Hot Modulus of Rupture
  - Atmospheric
  - Protective Gas
- Hot Crushing Strength
- Hot Abrasion Resistance
- Creep in Compression
- Refractoriness Under Load
- Thermal Conductivity
- Hot Stage Microscopy
- Dilatometry
- Permanent Linear Change

Tests at Room Temperature

- Bulk Density
  - Water Method
  - Hg Method
- True Density
  - He Method
- Particle Size Analysis
- Pore Size Distribution - Hg
- Specific Surface
- Cold Crushing Strength
- Cold Modulus of Rupture
- Young´s Modulus
- Abrasion Resistance
- Gas Permeability

Chemical Analysis

Solid Chemical Analysis

- XRF
- Elementary Analysis
  - C, S, N - LECO
- SiC with / without Nitride

Wet Chemical Analysis

- ICP OES
- Atomic Absorption Analysis
- Ion Chromatography
- Photometry
- Si_{met} / Al_{met}
- Acid Solubility

Mineralogical Analysis

XRD

- Qualitative Analysis
- Quantitative Analysis
  - Rietveld
  - external / internal Standard Methods
- Degree of Crystallinity
- Crystallite Size Estimation
- SWeRF$_{cs}$ Analysis on Silicate Materials
- In-situ XRD up to 1100° C

Microscopy

- Structure Analysis
- Wear Mechanism
  - Infiltration
  - Transformation
- Material Damage Analysis
- Grain Size Determination
- Customized Testing Methods

Deutsches Institut für Feuerfest und Keramik GmbH

Rheinstr. 58
56203 Höhr-Grenzhausen

+49 2624 9433-200

info@difk.de

www.difk.de

Deutsches Institut für Feuerfest und Keramik GmbH

DIFK

DIFK Deutsches Institut für Feuerfest und Keramik GmbH

Worldwide Leading Laboratory

DIFK Deutsches Institut für Feuerfest und Keramik GmbH is one of the worldwide leading laboratories in the field of material testing of refractory and ceramic raw materials, products and system solutions.

Accredited by DAkkS

The laboratory is accredited by the DAkkS according to DIN EN ISO/IEC 17025:2018. Common chemical, physical, mineralogical and high-temperature measuring methods are used according to international standards and rules e.g. DIN, EN, ISO, ASTM, JIS, ABNT, API, UOP, CIR, etc.

40 Years Experience

Maximum customer orientation, promptness and reliability have characterised the working methods of DIFK GmbH for more than 40 years.
The experienced and consistently trained employees work together with the best possible equipment of a modern laboratory.

Full Service

Advising customers on standard testing tasks, on solving individual problems and on the selection of the most suitable testing methods are at the centre of the dialogue to maintain maximum customer satisfaction.

Customer Focus

DIFK has also specialized in customised test methods, especially at temperatures > 1000 °C and advises its customers competently on all questions concerning to refractory materials, products and their applications.

DIFK

Your partner for fast, confidential and precise refractory material testing and customer consulting.

Our most Important Industrial Partners

- Iron and Steel
- Non-Ferrous Metallurgy
- Glass
- Cement and Lime
- Chemical Industry
- Power Generation
- Waste Incineration
- Ceramic Industry
- Extractive Industry

Physical Testing at Ambient Temperature

Technologically most advanced equipment can be used for all measurements of refractory raw materials, refractory products and refractory linings. The DIFK portfolio includes more than 100 standardised test procedures.

The determination of all state-of-the-art physical properties at ambient temperature such as density, apparent porosity, cold crushing strength, particle size distribution, pore size distribution of shaped and unshaped refractory materials are part of DIFK wide range of services.

Physical Testing at High Temperatures

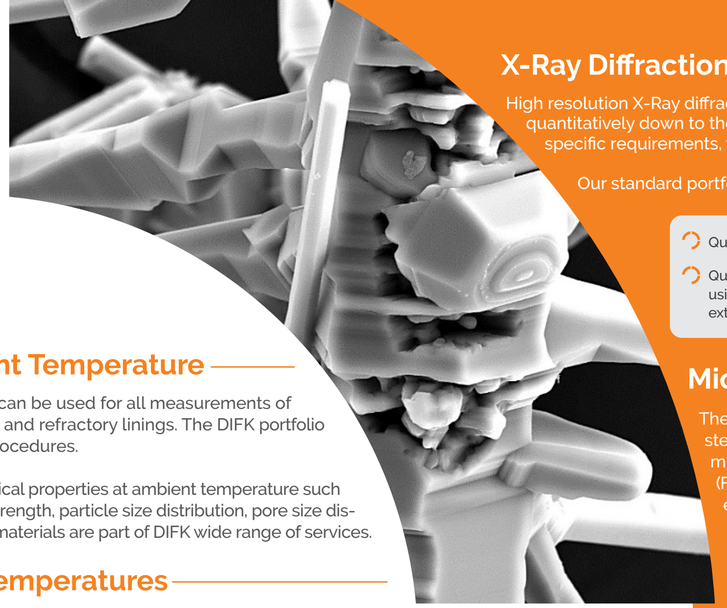
One of the special features of DIFK services are physical testing procedures at high temperatures. All relevant physical properties at temperatures up to 1700 °C can be determined under oxidised, reduced or protected atmospheres:

- Refractoriness Under Load
- Thermal Conductivity
- Hot Compressive Strength
- Creep in Compression
- Thermal Shock Resistance
- Abrasion Resistance up to 1400°C
- Hot Modulus of Rupture
- Simultaneous Thermal Analysis
- Hot Stage Microscopy

Corrosion Resistance of Refractories against Melts, Slags and Reducing Gas Atmospheres

The wear of refractory linings in contact to iron and steel melts as well as non-ferrous melts and their metallurgical slags can be detected and quantitatively evaluated.

The gas corrosion behaviour of refractories in carbon monoxide, hydrogen and various CO-H_2 reducing atmospheres within atmosphere-controlled furnaces can be determined.
For the solution of your individual tasks and challenges, we develop your individual customised test procedure.



X-Ray Diffraction Analysis

High resolution X-Ray diffractometry (XRD) is used to evaluate your samples qualitatively or quantitatively down to the trace range. From standardized analysis methods to customer-specific requirements, we offer a flexible selection of evaluation methods.

Our standard portfolio for X-Ray diffraction analysis includes:

- Qualitative Phase Analysis
- Quantitative Phase Analysis using Rietveld Analysis and/or external/internal Standard Method
- Crystallite Size Estimation
- SWeRF$_{cs}$ Analysis on Silicate Materials
- In-situ XRD at Temperatures up to 1100°C

Microscopic Analysis

The microscopic equipment of DIFK GmbH ranges from a simple stereo magnifier to reflected-light, transmitted-light and polarisation microscopy to state-of-the-art field emission electron microscopy (FE-SEM) with connected energy dispersive spectroscopy (EDS) for elemental analysis.

Our standard portfolio for microscopic analysis includes:

- Structural Analysis
- Material Defects
- Wear Mechanisms
- Customised Methods

Chemical Analysis

Advanced chemistry methods such as X-Ray fluorescence (XRF), combustion analysis for carbon, sulphur and nitrogen analytics, traces analysis by inductively coupled plasma optical emission spectrometry (ICP-OES) and ion chromatography (IC) are used for qualitative and quantitative determination of elements from lithium to uranium.

The standard chemical analysis portfolio includes:

- XRF element determination of all common ceramic and refractory materials
- IR spectrometers for sulphur and total carbon (Leco CS744 and Leco RC612) for carbon phase characterisation (inorganic/organic)
- Nitrogen determination by combustion analysis using thermal conductivity (Leco TN 400) as part of the complex evaluation of nitride-bonded silicon carbide.
- Methods for wet chemical evaluation including inductively coupled plasma optical emission spectrometry (ICP-OES) spectrometer.
- Ion chromatograph for the anion analysis of e.g. fluoride or chloride