The Groz-Beckert central laboratory
Overview and service specifications
Material testing

Determination of the chemical composition of inorganic materials
- Emission spectroscopy (Fe, Ni, Al, Cu basis)
- C, Si, Mn, P, S, Cr, Ni, Mo, Cu, Nb, V, Ti, Al, W, Co, As, Pb, Sn, Zr, Bi, B, Zn, Ca, Sb, Ta, N
- Glow discharge optical emission spectroscopy (GDOES)
- Bulk and depth profile analysis, e.g. of nitriding and PVD coating
- DC and RF excitation
- Energy-dispersive measurements (EDX) in scanning electron microscope
  - Qualitative surface analysis
  - Elemental mapping images
  - Linescan and point analysis
- Determination of elements with X-ray fluorescence analysis RFA
  - 40 Elements of the periodic table
  - Solid and liquid samples
- Determination of elements via inductively coupled plasma spectrometer ICP
  - Trace analysis in ppm range (DIN EN 10351, DIN EN ISO 11885)

Mechanical-technological tests on various materials
- Tensile testing according to DIN EN ISO 6892-1
- Shear strength of riveted and adhesive connections
- 3-point and 4-point bending test to 150 kN
- Various other strength tests
- Hardness testing:
  - according to Brinell DIN EN ISO 6506-1
  - according to Vickers DIN EN ISO 6507-1
  - according to Rockwell DIN EN ISO 6508-1
  - Shore hardness according to DIN ISO 7619
  - Nano hardness testing DIN EN ISO 14577
  - Roughness testing DIN EN 10049
  - Scratch test of layers (ASTM C1624)

Metallographic testing
- Structures on steel and non ferrous metals (copper, nickel, aluminum, titanium etc.)
- Determination of grain size (DIN EN ISO 643, DIN 50601)
  - Case depth DIN EN 10328
  - Nitriding depth (DIN EN 50190-3)
  - Decarburization (DIN EN ISO 3887)
  - Non-metallic inclusions
  - Carbide structure

Coating thickness testing
- Calotte grinding for PVD, galvanic layers
- X-ray fluorescence analysis of coating thickness
- Admittance measurement
- Determination of thickness of anodic film and lacquer coating

Microscopy
- Scanning electron microscope Zeiss Sigma VP for non-conductive samples
- Various stereo and light microscopy up to 1,500x optical magnification

Metrology
- Tactile and optical measuring machine to 600 x 600 mm component size
- Fringe light projection for 3D measurements on small components, e.g. cutting edge of tools

Hot gas and melt extraction
- Determination of:
  - oxygen content (DIN EN 10276-2)
  - hydrogen content
  - nitrogen content
  - carbon and sulfur content of steel (ASTM E1019)

Dilatometer testing
- Setup of time-temperature-transformation curve for ferrous alloys (SEP1680 1990-2)

Corrosion testing
- Current density-potential corrosion measurements ASTM G59
- Stress corrosion cracking DIN EN ISO 7539
- Intercrystalline corrosion (Huey, Strauss Test) DIN EN ISO 3651-1,-2
- Salt-spray tests according to DIN EN ISO 9227
- Corrosion tests in artificial atmospheres from -70 °C to +180 °C, variably selected humidity, freely programmable cycles
Polymer and oil or lubrication analysis

Polymer analysis
- Basic principles according to DIN EN ISO 1043-1 to DIN EN ISO 1043-4
- FTIR analysis
- Determination of:
  - melting point according to DIN EN ISO 11357-1
  - glass transition according to DIN EN ISO 11357-2
  - enthalpy of melting and crystallization according to DIN EN ISO 11357-3
  - specific heat capacity according to DIN EN ISO 11357-4
  - reaction times and temperatures according to DIN EN ISO 11357
  - density according to DIN 1183-1
  - water absorption according to DIN 53475
  - ash in muffle furnaces or with TGA according to DIN EN ISO 3451
  - MFR/MVR according to DIN EN ISO 1133-1
  - stress crack sensitivity

Analysis cooling lubricants according to TRGS 611
- Determination of Co and Cu via ICP according to DIN 51399
- Determination of pH value according to DIN EN ISO 10523
- Bacteria test via dipslide
- Determination of:
  - concentration via refractometer
  - water hardness according to DIN 38406 H6
  - nitrite content according to:
    - DIN EN 28777 (spectrometer) or with test strips
    - DIN EN ISO 10304-1 (IC) or with test strips

Minimum requirements for lubricating oils according to DIN 51517, DIN 51520, DIN 51521, DIN 51524
- Sampling according to DIN 51570-1, DIN 51570-2, DIN EN ISO 3170
- FTIR analysis
- Determination of viscosity according to DIN EN ISO 3104, DIN 51659-2 (draft)
- Tribological testing according to DIN 51834-1 to DIN 51834-4
- Characterization of textile oils according to DIN 62136-1, DIN 62136-2
- Lini test: washability of oils
- Determination of:
  - viscosity index according to DIN 51563, DIN ISO 2909
  - density according to DIN 19757
  - flash and fire points according to DIN EN ISO 2582
  - aromates content
  - oxidation stability with Rancimat
  - pH value according to DIN EN ISO 20843
  - neutralization number according to DIN 51558-2
  - saponification number according to DIN 51559-1 and DIN 51559-2
  - pour point via DSC or according to DIN ISO 3016
  - water content according to DIN 51777-1 and DIN 51777-2
  - metals (RFA) according to DIN 51363-2, DIN 51390-2, DIN 51391-2, DIN 51577-4, DIN ISO 15597, DIN EN ISO 8754
  - chlorine content (RFA) according to DIN 51577-4, DIN EN ISO 15597
  - boiling range according to DIN 51435
  - contamination (centrifuge) according to DIN 51365
  - Brugger number according to DIN 51347-1, DIN 51347-2
  - BHT content

Special testing
- Particle-size analysis according to ISO 13320
- UV stability testing
- color fastness
Chemical analyses

Water and wastewater analysis according to DIN 38402
- Bacteria test via dipslides
- Determination of concentration via ICP
- Determination of:
  - chloride ions according to DIN 38405-1
  - fluoride according to DIN 38405-4
  - sulfate according to DIN 38405-5
  - phosphate according to DIN 38405-9
  - bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate according to DIN EN ISO 10304-1
  - chromate, iodide, sulfite, thiocyanate, thiosulfate according to DIN EN ISO 10304-3
  - chloride, chlorate, chlorite according to DIN EN ISO 10304-4

Instrumental analysis
- GC-MS: Analysis of organic connections to 300 °C evaporation point
- HPLC-MS
- Titrimetry
- Ion chromatography IC
- Wet chemical analysis
- Analysis galvanic baths

Textile testing on fibers

- Breaking force and elongation according to DIN EN ISO 5079
- Friction behavior (fiber/metal)
- Determination of:
  - Linear density according to DIN EN ISO 1973 (vibroscope method)
  - Fiber diameter
  - Crimp properties (Hoechst (Trevira) method)
  - Fiber length according to DIN 53808-1 (measuring of individual fibers)

Textile testing on yarns and threads

- Determination of:
  - Linear density by the skein method according to DIN EN ISO 2060 (yarn from packages)
  - Linear density of monofilaments according to DIN EN 13392
  - Linear density of single and plied yarns based on DIN 53830 (short length method)
  - Single-end breaking force and elongation of yarn according to DIN EN ISO 2062
  - Tensile properties of monofilaments according to DIN EN 13895
  - Twist in yarns according to DIN EN ISO 2061 (direct counting method)
  - Knot tensile test for single and plied yarns according to DIN 53842-1
  - Loop tensile test according to DIN 53843-1
  - Elastic behavior according to DIN 53835-2
  - Friction measuring on yarns
Textile testing on fabrics

Analysis of textile structure
• Determination of:
  • number of stitches per unit length and unit area according to DIN EN 14971
  • number of threads per unit length DIN EN 1049-2
  • yarn length ratios in woven and knitted fabrics according to DIN 53852
  • the mass portion of warp and weft according to DIN 53856
  • mass per unit area according to DIN EN 12127 and DIN EN 29073-1
  • thickness of textiles and textile products according to DIN EN ISO 5084 and DIN EN ISO 9073-2
  • compression of textiles and textile products according to DIN 53885

Investigation of performance characteristics
• Analysis of textile structure:
  • Static puncture test (CBR test) according to DIN EN ISO 12236

• Determination of bursting properties, bursting strength and bursting distension according to DIN EN ISO 13938-2 (pneumatic method)

• Determination of permeability of fabrics to air according to DIN EN ISO 9237 and DIN EN ISO 9073-15

• Behavior when exposed to abrasion
  • Determination of the abrasion resistance by Martindale method:
    • of specimen breakdown according to DIN EN ISO 12947-2
    • of mass loss according to DIN EN ISO 12947-3
    • assessment of appearance change according to DIN EN ISO 12947-4
    • fabric propensity to surface fuzzing and to pilling according to DIN EN ISO 12945-2 (modified Martindale method)
    • of abrasion resistance according to DIN EN ISO 5470-2 (rubber- or plastics-coated fabrics)

• Behavior when exposed to water
  • Determination of:
    • water absorption of textile fabrics according to DIN 53923
    • resistance of textile fabrics to water permeation according to DIN EN 20811, DIN EN ISO 9073-16 (hydrostatic pressure test)

Investigation of tensile properties
• Determination of maximum tensile force/elongation:
  • Strip method according to DIN EN ISO 13934-1
  • Grab method according to DIN EN ISO 13934-2
  • of nonwovens according to DIN EN ISO 29073-3

• Testing of tenso-elastic behavior according to:
  • DIN 53835-13 (single application of tensile load between constant extension limits)
  • DIN 53835-14 (single strain between two force limits)

• Determination of tear properties
  • with single-tear method according to DIN EN ISO 13937-2
  • with trapezoid test according to DIN EN ISO 53859-5
  • of nonwovens according to DIN EN ISO 9073-4

• Determination of adhesive force
  • Delamination testing according to DIN 54310, DIN 53630

• Seam tests
  • Determination of slippage resistance of yarns in woven fabrics according to:
    • DIN EN ISO 13936-1 (Fixed seam opening method)
    • DIN EN ISO 13936-2 (Fixed load method)

  • Determination of maximum tensile force with:
    • Strip method according to DIN EN ISO 13935-1
    • Grab method according to DIN EN ISO 13935-2
Other analyses

Optical analyses
• Stereo microscope, light microscope 630x magnification with different contrasting methods
  and scanning electron microscope for:
  • longitudinal- and cross-section investigation, et al. microtom sections
  • Structure and surface investigation
  • Thermo-microscopy

Textile-chemical analyses
• Determination of impurities, fiber additives and extractable substances
• Material identification and composition
• Determination of density based on DIN EN ISO 1183-1 (immersion method)
• Quantitative, chemical fiber analysis, separation of binary mixtures according to DIN EN ISO 1833
• Determination of pH value according to DIN EN ISO 3071, DIN 54275

Other methods of analysis
• Examination of delustering content
• Creation of surface replica
• Testing of thermal behavior (DSC, TGA)
• Spectral analysis via infrared spectroscopy (FTIR)
• X-ray fluorescence analysis (RFA)
• Tests for analytical reactions
• Rheologic testing (viscosity, viscoelastic behavior)