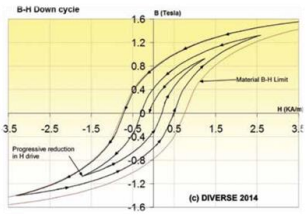
CMPhy
MESURES PHYSIQUES





Services to Industries and Laboratories Catalog

CMPhy – 26 rue Paul Sabatier - 71530 – CRISSEY
www.cmphy.fr – *contact@cmphy.fr* – 03 85 47 47 20

Summary of services

Characterization of Materials by Non-Destructive Methods

Magnetic properties

Permanent magnets: Alnico - Ferrite - SmCo - NdFeB

Standard measures:

- **B-H Hysteresis Loop with HcJ/ HcB/ Br/ BH max/ B surface magnetic mapping (homogeneity) / vector and magnet angle**

Special measurements of these quantities / quality control:

- At High temperature: from 50 ° C to 250 ° C
- After corrosion according to the NF ISO 9227 test standard
- After mechanical wear / vibration / endurance tests

IEC 60404 - 5, ASTM A977/A977M Standards

Ferromagnetic steels: Fe - C and special alloys

Standard measures:

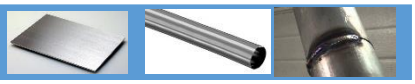
- **B-H hysteresis loop with Hc / Br / µr / µ = f (H) measurements**

Special measures of these sizes:

- At Low and High temperatures: from -25 ° C to + 1100 ° C
- Under stress (traction, other), after heat treatment, mechanical
- Depending on the frequency of DC to 500 kHz

IEC 60404-4, ASTM A773 , NF EN 10330 Standards

Stainless steels:



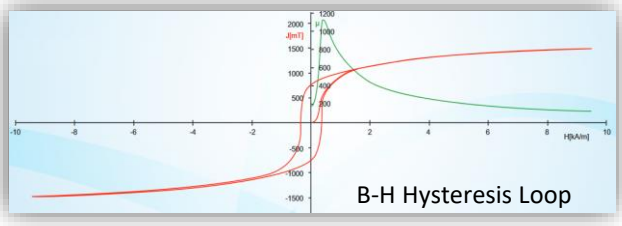
Standard measures:

- **Relative magnetic permeability µr / Hc / µr mapping of finished part**
- **Evaluation of para or ferromagnetic behavior, material quality**

Special measures: After thermal-mechanical treatment, welding, ferrite content

IEC 60404-15, ASTM A342 Standards

B-H measuring bench



Magnetic saturation system

Characterization of Materials by Non-Destructive Methods

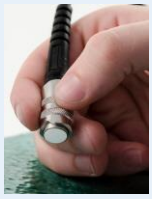
Electrical Properties

Ferromagnetic steels: Fe - C and special alloys

Non-magnetic steels: Stainless steels, Al, Cu, Sn, Gold alloys, others

Standard non-contact measurements:

- **Conductivity (σ) in %IACS or MS/m and electrical resistivity (ρ) on materials, parts with or without coating (evaluation of its influence), dielectric permittivity Ɛ, dielectric strength**



Special measures of these quantities:

- At High temperature: from 50 ° C to 250 ° C
- After corrosion according to the NF ISO 9227 test standard
- After mechanical wear / vibration / endurance tests
- Under stress (traction, other)

E1004-99 EC, ASTM B203 Standards

Coatings - Polymers - Carbon composites - Dielectrics - Liquids

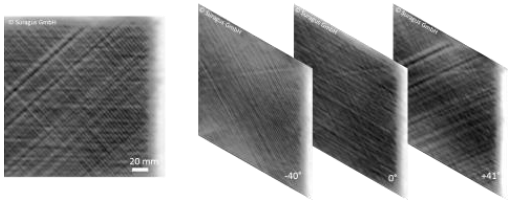
Standard non-contact measurements:

- **Conductivity (σ) in MS / m and electrical resistivity (ρ) on materials, in ionic solutions, dielectric permittivity Ɛ**
- **Dielectric quantities and constants, contact resistance (Ω / cm²)**

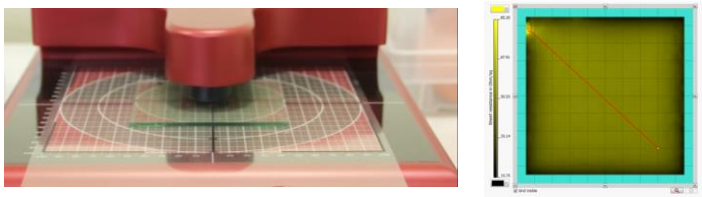
Special measures of these quantities:

- At Low and High temperatures (to be defined according to the nature of the material)
- Under mechanical stress

E1004-99 EC, EN ISO 15091, ASTM B203 Standards



Fiber orientation / carbon density testing



Resistance test of a dielectric film / layer

Characterization of Materials by Non-Destructive Methods

Mechanical Properties and Structure Analysis by Non Destructive Methods - NDA Techniques

Solid Materials: Metals - Polymers - Composites - Ceramics - Glass

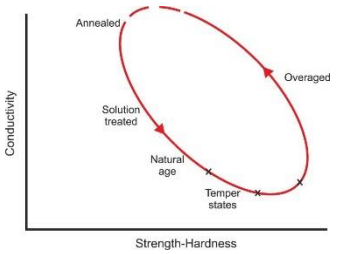
Standard measurements by **ultrasonic methods:**

- ❑ **Modulus of Elasticity E, Shear Modulus G, Poisson's ratio**

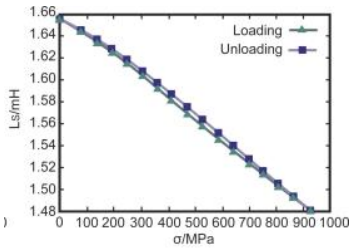
Special measures:

- ❑ **Residual stresses σ, hardness by eddy currents**
- ❑ **Metallurgical analyzes** by Ultrasonic / Electromagnetic methods

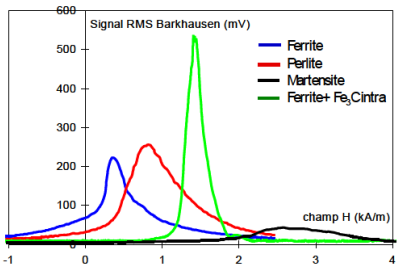
ASNT Non Destructive Testing Handbook reference



Hardness by Eddy Currents



Stress by variation of electrical resistivity



Magnetic noise depending on metallurgical state

Liquid materials of all kinds

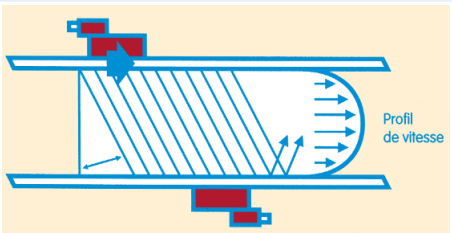
Standard measurements by **ultrasonic methods:**

- ❑ **Rheology: Viscosity, density, particle concentration, flow rate, speed, Re**

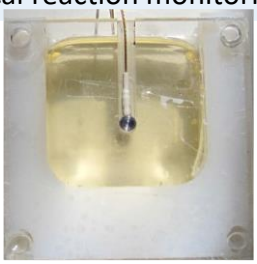
Special measures:

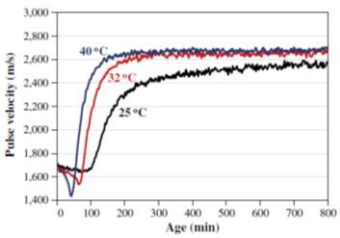
- ❑ At Low and High temperatures / chemical reaction monitoring, polymerization

ASNT Non Destructive Testing Handbook reference



Flow profile by ultrasonic measurements





Monitoring polymerization by ultrasonic method

Mechanical and thermal characterization of materials

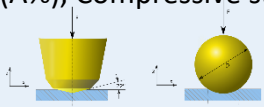
Mechanical properties

All types of materials: Metals - Polymers - Composites - Ceramics - Glass

Tensile, compression, bending tests (at different temperatures)

- ❑ Modulus of Elasticity E, Shear G, Poisson's ratio, Yield strength Re, Strength Rm and Elongation at break (A%), Compressive strength

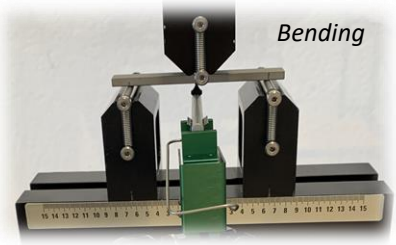
Vickers, Brinell hardness measurement



NF EN ISO 6892 , NF EN 12390 NF EN ISO 178, NF EN ISO 3327, ISO 6506/7 Standards

Traction

Compression



Bending

Hardness

Thermal properties

All types of materials: Metals - Polymers - Composites - Ceramics - Glass

Dilatometry:

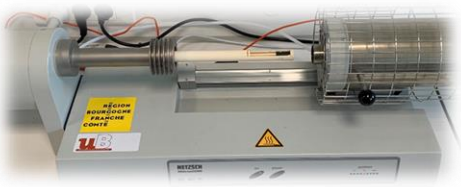
- ❑ Coefficient of thermal expansion over the range : ambient temperature to 1000°C

Measurement of thermal properties:

Thermal conductivity λ (W.m-1.K-1), thermal capacity Cp (J / (kg.K))

ASTM E473-85, ASTM E 228, ISO/DIS 11357-8 Standards

Thermal properties measurement bench



Dilatometer

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Matter and metallurgical characterization of materials

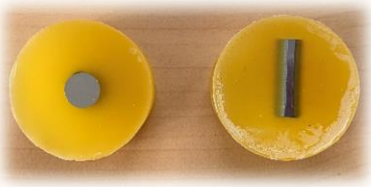
Matter and microstructure characterization

Iron-Carbon Alloys: Fe-C Steels - Cast Iron

Metallographic analyzes

- ❑ Average grain size, type and average proportion of metallurgical present phases
- ❑ Analysis of the microstructure by scanning electron microscopy (SEM)
- ❑ Analysis of the crystal structure of the phases present by X-ray diffraction

ASTM E112 ; NF EN ISO 643 Standards



Mirror polish

Optical microscope

Microstructure of a steel (x 500)

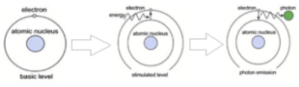
Material characterization and chemical composition

All types of metal alloys: Fe-C steels - Cast iron - Aluminum alloys - Copper alloys - etc ...

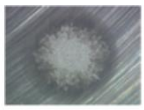
Spark source optical emission spectrometry:

- ❑ Determination of the mass percentages of the chemical present elements

NF EN 1426 ; NF EN 15079 Standards



Spark source optical emission spectrometer



Typical spark

Fe-C steel samples analyzed by spark spectrometry

Calibration of measuring devices, checks of test blocks

Calibrations & Verifications of Non Destructive Testing Equipment

Calibrations - Meters for Magnetic Particle Testing (MT) – Penetrant Testing (PT)

- ❑ **Magnetic field meter**

➔ All types of probes (tangential, normal), device brand, waveform (AC/DC)

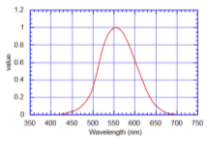
- ❑ **Luxmeter – 365nm UV Radiometer**

➔ All types of probes, device brand, single or combined measurement

NF EN ISO/CEI 17025, ISO 3452, ISO 9934

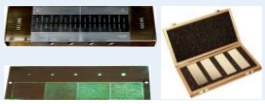
NF C42-710, ISO/CIE 20476, EN3059

Calibration laboratory according to NF EN ISO 17025 standard



Verifications - Test blocks and standards for MT – PT

- ❑ C indicator, Ketos Ring
- ❑ Reference pads n°1 and 2, PSM, TAM



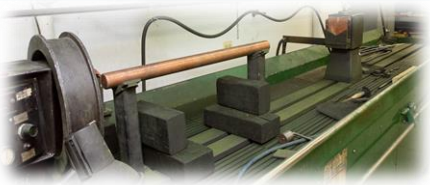
NF EN ISO/CEI 17025, ISO 3452, ISO 9934, ASTM E 1444-01 Standards

Verifications - Equipment & Accessories MT – PT

- ❑ Ultraviolet 365nm lighting (LED, Neon, Bulb)
- ❑ Contact / immersion / ambient thermometers 10°C to 80°C
- ❑ Electromagnets, magnetization / degaussing coil
- ❑ Portable current generators, test benches
- ❑ Penetrant testing line (manometers, drying oven, lighting, suction)

NF EN ISO/CEI 17025, ISO 3452, ISO 9934, FD X 07-028 et 029 Standards

Drying oven



Verification of MT and PT benches

Calibration of measuring devices, checks of test blocks

Calibrations & Verifications of Non Destructive Testing Equipment

Calibrations - Eddy Current Testing devices

- ❑ **Portable or computer-based eddy current measurement console**

➔ Any type of brand, mono and phased array

ISO 15548-1:2013 Standards

Calibrations – Radiology Equipments

- ❑ **Densitometer, X-ray viewer, Luminance meter**

➔ Any type of brand

EN 25580 et ASTM 1390, ISO/CIE 19476, NF C42-711 Standards

Calibrations - Ultrasonic Testing devices

- ❑ **Portable or computer-based ultrasonic measurement console**

➔ Any type of brand, mono and Phased Array

ASTM E-317, EN12668, EN18563, ISO 16831 Standards

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Calibration of measuring devices, checks of test blocks

Calibrations & Verifications of Non Destructive Testing Equipment

Calibrations - Coating thickness gauges

- **Coating thickness gauge**
  on magnetic or non-magnetic base metal

  All brands / types devices

NF EN ISO 3882:2003 / 2178 / 2360, ASTM D 6132 Standards

Calibrations - Hardness meters

- **Hardness meter by the Leeb method**
  on metallic materials

  All brands / types devices

ASTM A956 et EN ISO 16859, ASTM D 2240 Standards

Calibrations - Metrology devices

- **Micrometer, caliper, thickness gauge, depth gauge check**

NF E11-091 / NF EN ISO 13385-1 / NF E 11-090/091/ 095/096/ 099 et E 11-097/098 Standards

Calibration of measuring devices, checks of test blocks

Magnetic field measuring calibrations

Measurement ranges from 1 µT to 9 Tesla

- **Three ranges of measurements**
  - ✓ Low field range: 1µT to 45 mT
  - ✓ Medium field range: 43 mT to 2.1 T
  - ✓ Strong field range: 2T to 9T (superconducting magnets)
- **1-axis or 3-axis measuring probe**
- **Special calibrations**

  In AC for a given frequency from 1 Hz to 1 MHz
  For a working temperature of -40°C to + 160°C
  Angular calibration for 3-axis sensor

IEEE 1309-2096 NF EN ISO/CEI 17025 Standards

Low gap electromagnet for high field calibration (> 2 Tesla)

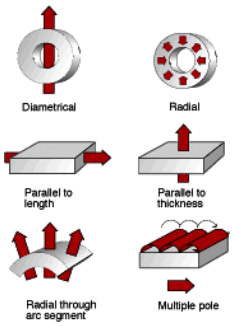
Helmholtz assembly for 1-axis measurement calibration

Assemblage 3D Helmholtz pour l'étalonnage de mesure 3 axes

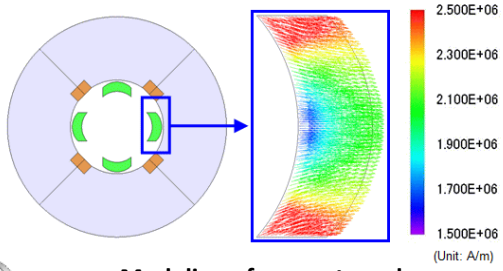
Magnetization - Degaussing of machines, prototype parts, tools and magnets

Magnetization of magnets and magnetic assemblies for validation of industrial prototyping

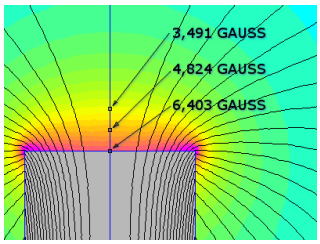
Magnetization / degaussing test laboratory



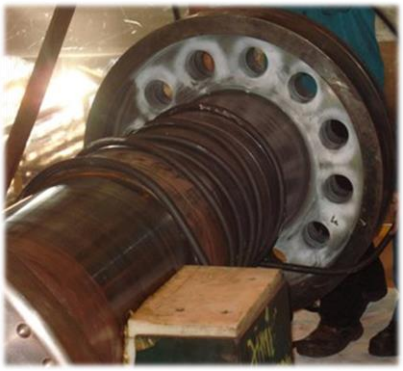
Any type of polarization



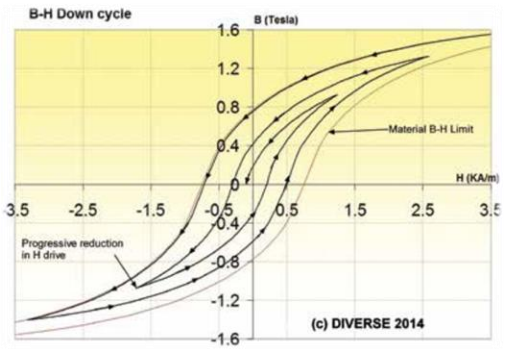
Modeling of magnets and magnetic assemblies



Very low frequency degaussing of massive parts or complex assemblies, small series parts



Complete degaussing of massive parts



Residual magnetic field less than 240 A/m after degaussing

Measuring tools for control of degaussing

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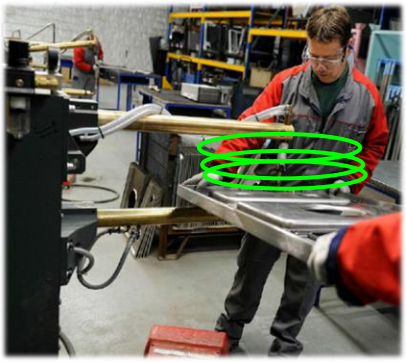
On-site interventions and expertise

Electromagnetic measurements

Measurements on industrial site / medical laboratory (weak fields and strong fields, large frequency from DC to several MHz)

➔ **Compliance with European Directive 2013/35 / EU:** Zone marking, EM shielding and magnetic compensation system

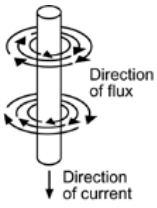


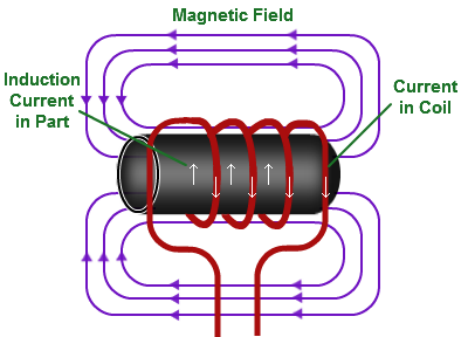
Magnetic disturbances generated on the equipment

Magnetic and/or electric arc blowing

Electromagnets: Environment and residual magnetic fields

Advice on setting up equipment and installations with a magnetic field source





Magnetic particle testing bench, welding machine, induction heating / hardening