Materials Engineering
TECHNOLOGICAL SERVICES

TECNALIA offers its expertise in materials conducting services like Materials Selection Characterisation, In Service Behavior, Failure Analysis, Residual Life Prediction and Life Extension.
TECNALIA Research & Innovation is the first privately funded applied research centre in Spain and one of the leading such centres in Europe. A combination of technology, tenacity, efficiency, courage and imagination.

We identify and develop business opportunities through applied research. Inspiring Business is a different, unique vision: we visualise ideas that generate value and provide creative technological solutions to produce real results.

At TECNALIA we are organised in 6 fully interconnected Business Divisions. Cooperation works thanks to the transversality of teams, projects and clients collaborating with each other, combining expertise and commitment. Our best asset is our team, made up of more than 1,500 experts who work to transform technology into GDP in order to improve people’s quality of life by generating business opportunities for companies. We are committed to the future, society, our planet and our environment. This responsibility provides focus to our values and reinforces our activities.

"TECNALIA transforms Technology into GDP to improve people’s quality of life by generating business opportunities for Companies"
Materials Engineering | Technological Services

We are experts in materials, focused on technical consulting, advanced studies, analysis and evaluations of materials. **More than 60 years experience in materials**, knowledge and talent to be effective, close and decisive.

TECNALIA deploys all its technological potential to meet the demand of many industrial sectors. We rely on our multidisciplinary laboratories to respond to our customers' demands.

100% customer-oriented mindset. An attitude and a way of working oriented to results, because customers’ concerns are also our concerns.

**FIELDS**

01. Testing and Evaluation

02. Fitness for Service

03. Welding

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Testing and Evaluation

FIELDs

• Mechanical testing.
• Chemical analysis.
• Materialographic / Metallographic Analysis.
• Corrosion testing.
• Non-Destructive Testing (NDT).
• Renewable Energy.
• Oil & Gas.
• Foundry and Steelmaking.
• Metalworking and Welding Industry.
• Aeronautics, Railway and Automotive.
• Shipping and Offshore Industry.
• Biomaterials Industry.
• ... (continued)

CUSTOMERS

• Metallic materials (steels, foundries, aluminum alloys, copper, nickel, titanium...), Plastics, Composites, Ceramics, Paintings and Coatings, Weldments.
• Testing and Analysis acc. to standards or particular specifications.
• Analysis and Diagnosis of Non-Conformities.
• Quality Control / Compliance Evaluation.
• Characterisation and Reverse Engineering.
• Positive Material Identification (PMI).
• Tests and Experiments design.
• Review and design of product and process specifications.

SERVICES

Our laboratories are accredited according to national and international quality standards and feature multiple authorisations.

TECNALIA has a large network of accredited laboratories and qualified staff with extensive experience in the field of testing and characterisation of materials and parts. This capacity and knowledge allows TECNALIA to offer a wide range of services (testing, assessment, diagnosis, consulting...) in the different areas related to material and parts properties (mechanical, chemical, etc.).

Materials characterisation studies materials microstructure, their properties and relationship with their composition and thermomechanical history. The knowledge of properties, behavior and fitness in different service conditions of materials is the basis of multiple fields, from quality control to new product development, through condition monitoring and evaluation or residual useful life.
Study and knowledge of behavior in service of materials and systems is a key point at different stages of the life cycle of a part. Materials are critical during design stages as during manufacturing and assembly stages and useful life. Knowledge of materials and their properties is crucial in redesign, failure analysis and prevention, condition assessment, prediction and useful life extension, flaw assessment and structural integrity. In a word, it is crucial all over the cycle life of the component, in terms of efficiency, durability, and integrity and safety.

### Fields

- Mechanics.
- Corrosion.
- High temperature.
- Erosion and wear.
- Friction.
- Renewable Energy.
- Oil & Gas.
- Aeronautics, Railway and Automotive.
- Metalworking and Welding Industry.
- Foundry and Steelmaking.
- ... 

### Customers

- Metallic parts, Weldments, Plastics, Composites, Ceramics, Paints and Coatings.

### Services

- Failure Analysis and Prevention (RCA).
- Selection of materials, processes and Protection Systems.
- Condition Assessment and Residual Useful Life Prediction.
- Flaw Assessment (FA, ECA, FFS-FGP).
- Structural Integrity.
- Monitoring and Life Extension (Predictive Maintenance).
- Product development.
- Product validation.

**TECNALIA** has wide experience in materials, their properties and degradation mechanisms and failure. This knowledge enables **TECNALIA** to offer services related to materials and parts in service behavior (selection of materials, failure analysis, residual life prediction, flaw assessment...) in the different possible areas (mechanics, corrosion, friction, high temperature, etc.).
Welding

Welding is a fundamental process in the industrial world. It is present in manufacturing, assembly and even in maintenance and recovery of many parts and assemblies. Welding application is wide, not only for parts union purpose, but also in order to confer specific properties against corrosion, wear, etc. This area is in constant evolution in order to respond to the market needs and to new requirements and regulations more and more demanding with regard to welding procedures.

Our welding engineers have a deep knowledge and experience of welding processes, including regulatory and industrial requirements, but also in the behavior of these welded materials and parts in service.

Technical consultancy on industrial welding (processes, certification, control and testing) and onsite quality control of welds.

CUSTOMERS

- Metalworking and Welding Industry.
- Energy and Oil & Gas.
- Aeronautics, Railway and Automotive.
- Construction Companies
- Unique Big Constructions
- Foundry and Steelmaking.

SERVICES

- Welding workshop layout.
- Prototypes manufacturing collaboration.
- Welding Procedure Specification (WPS) and Welder Qualification.
- Weldments characterisation, analysis, of results and corrective actions.
- Customised Technical training.
- Analysis of methods and improvement actions.
- Steels, light alloys, nickel alloys, copper alloys, etc.
Laboratories

Mechanical testing lab is accredited to perform static and dynamic tests according to UNE-EN ISO / IEC 17025 standard, either at room or high and low temperature (tensile, fatigue, compression, hardness, impact Charpy tests, fracture mechanics...).

We can also perform singular tests, such as residual stresses testing, creep tests or instrumented/monitored tests.

The laboratory has its own workshop to machine devices and test specimens. This machining capacity is highly appreciated by customers and inspectors, for traceability and quality guaranty, as for shortening delivery time, while reduced deadlines delivery.

Equipment / Tests /
- Tensile and compression tests at room temperature, in environmental chambers (from -70 ºC to +300 ºC) and in furnaces (up to 1100 ºC).
- Brinell, Rockwell and Shore hardness tests.
- Bend and Flexure Tests (from -70ºC to +300ºC).
- Fracture Mechanics (CTOD, KIC, J, GIC...).
- Axial Fatigue Tests, HCF, LCF (from -70ºC to 900ºC, depending on the type of test) and crack growth da/dN.
- Multiaxial Fatigue Rig with actuators up to 10kN, 50kN and 100kN.
- High Frequency Axial Fatigue (up to 250kHz).
- Rotating bending fatigue.
- Creep Tests
- Charpy Impact Tests (from -90ºC to 300ºC, and at -196ºC).
- Extensometry: Strain and Stress measurement by means of extensometric gauges.
- Residual Stress Testing (RX and Hole Drilling)

Chemical laboratory of TECNALIA performs chemical analyses of different nature and origin materials (ferrous, light alloys, inorganic waste...).

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Analyses / Chemical analysis of metals in wide range of metallic materials:
- Ferrous materials: medium and low alloy steels, stainless steels, foundries, manganese steels, tool steels and free machining steels.
- Non-ferrous materials: Aluminum, Cobalt, Copper, Magnesium, Zinc, Nickel, Lead, Tin, Titanium... pure metals and alloys.

Chemical characterisation:
- Raw materials: molding sands, carbon coke, dolomites, magnetes, direct reduced iron, briquettes, ferroalloys, etc.
- Waste from foundry processes (slag, EAF dust, sands, etc.).

Chemical control:
- Baths for surface treatments (aeronautics): alkaline cleaning, TSA anodizing, chemical conversion, passivation, acid stripping, etc.

Equipment / Analyses /
- Automatic analysers for C, S, N, O and H.
- Spark Optical Emission Spectrometers for Fe, Al, Ni, Cu and Co alloys.
- Plasma Optical Emission Spectrometer (ICP-OES).
- Automatic titrator.
- High frequency remelt furnace with vacuum system.
The materiallography lab of TECNALIA is accredited according to UNE-EN ISO / IEC 17025 standard for many tests and analyses, and has a wide know-how in the analysis of materials and systems of different nature.

Experience is not limited to metallic materials and welds. Analyses of polymers, ceramics and composites is also covered. For this reason it is called materiallographic and not only metallographic.

Tests /
- Macrographic examination (magnification up to 50x).
- Analysis of all type of materials (microstructure, grain size, non-metallic inclusions, treatment and coating thickness...) by means of light microscopy (magnification up to 1,600x).
- Scanning Electron Microscopy (SEM) (magnification up to 200,000x).
- Identification of constituent elements by Energy Dispersive X-Ray Spectrometry (EDS).
- Identification of phases, residual stress measurement, textures, layer measurement by X-ray Diffraction (XRD).
- Vickers microhardness tests. Surface treatment depth determination.
- Phase/particles quantifying by means of image analysis.
- Metallographic replicas.
- Characterisation of welded joints.
- Micro-sectional analysis of electronic components welds.

Equipment /
- Light microscopes with incorporated digital cameras.
- Metallographic replicas and residual useful life.
- Digital images processing software.
- Portable equipment for non-destructive metallographic preparation and analysis.
- Scanning Electron Microscope (SEM) with EDX and WDS micro-analyser.
- X-Ray Diffraction Equipment (XRD).

Corrosion lab performs corrosion and ageing tests on materials and protection systems, according to customers specifications or national and international standards. The lab is accredited according to UNE-EN ISO / IEC 17025 standard.

Tests /
- Material corrosion tests according to standards (DIN, ASTM, NACE, ISO...).
- Painting and Coating Characterisation (thickness, adherence, impact, abrasion, hardness, flexibility, brightness, colour...).
- Pressure and Temperature Corrosion Tests (300 bar/300 ºC).
- Stress Corrosion Tests using the SSRT Technique.
- Material Ageing Tests (metals, polymers, paints, composites...).
- Electrochemical measurements (corrosion and pitting potential, resistance to polarisation, electrochemical impedance).

Equipment /
- Salt Spray Chambers.
- Kesternich.
- Climatic Chambers (with humidity control).
- UV Chambers.
- Tensile Machines for the SSRT technique.
- Dynamometric Rings for stress-corrosion tests.
- Autoclaves for high pressure and temperature testing.
Non Destructive Testing (NDT) lab of TECNALIA provides quality control tests and supports analysis and studies that require the location, orientation and size of defects, anomalies or damage.

Tests /
• Volumetric tests. Ultrasonic Testing (UT).
• Semi-volumetric tests. Magnetic Particle Inspection (MPI).
• Surface Tests. Dye Penetrant Inspection (DPI) and Visual Inspection (VT).
• Other Tests: Residual Stress measurement by means of the blind hole method (extensometry).

Equipment /
• Portable ultrasound apparatus.
• Impulse Echo Technique using straight, bireystal and angular probes.
• Ultrasonic immersion equipment (C-SCAN).
• Impulse-Echo or Transmission Technique.
• Magnetic Particle Equipment.
• Magnetic Yoke.
• Rig.
• Ultrasonic thickness measurement equipment.

ACCREDITATIONS AND AUTHORISATIONS
• Management systems certification UNI-EN 9100:2010 for quality in the aeronautics/defence (ASD) industry.
• ISO 14001 environmental management certification.
• Authorised by AIRBUS Laboratory Control for Testing Baths Surface Treatment and Metallic Materials.
• Approved laboratory by the ESA (European Space Agency) for “SMT Microsectioning” acc. to ECSS-Q-ST-70-38.
• NADCAP Accreditation for Chemical Processing.
• NADCAP Accreditation for Materials Testings.
We are experts in materials, focused on technical consulting, advanced studies, failure analysis, assessments and investigation of materials.

Customers References

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