

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
Ministry of Higher Education and Scientific Research



General Direction of scientific research and technological development

Research Center in Industrial Technologies
-CRTI-

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Outline

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Presentation of Research Center in Industrial Technologies CRTI

Presentation

Within the Minister of Higher Education and Scientific Research, Industrial Technology Research Center CRTI, created by Executive Decree No. 15-109 of May 3rd, 2015 amending the Executive Decree No. 92-280 of July 6th, 1992 establishing the welding and NDT research center (CSC), is a public establishment with a scientific and technological feature. CRTI has a human potential of 750 officials including 300 permanent researchers, 200 employees of technical staff and 150 experts and engineers falling within the subsidiary CSC Expertise Spa. Moreover, the center has several research structures and valuation across the national territory.

CRTI is attentive to the needs of its customers. The CRTI achievements in research and development, engineering, the flexibility of its methods, its deep knowledge with the customer are the key success factors of the mandates entrusted to the center. Under Executive Decree No. 03-461 of December 1 st, 2003, the CRTI has a dual purpose.

Research:

Research is the main mission of the center which relies on:

- Develop research programs necessary for the promotion of technical welding and nondestructive testing. For this reason 24 research teams deal as part of their research topics related to welding, nondestructive materials characterization, signal processing, metallurgical and steel industries.
- Develop welding techniques and testing them from the most common to the most modern. Provide technical support to the local industry by leveraging its expertise.
- Develop research programs in the steel and metal industry.

Delivering and technical assistance in the framework of a subsidiary:

The CRTI has over twenty years- of effective technical assistance that is involved in the areas of inspection and control through nondestructive teams highlighting search results in the context of assistance for the benefit of the industrial sector.

Research Areas

CRTI intends further to increase its scientific and technical potential of hosting new skills using their expertise through research and development thanks to its skills and convinced by the will of its researchers and the support staff that meet the challenge.

The CRTI also helps the training and qualification of staff operating in the field of welding and NDT.

Corrosion



Non-Destructive Testing



Welding and Related Techniques **Materials and industrial technologies**

CRTI chronicle


1985

Foundation of Welding Laboratory and Nondestructive Testing (LSCND)

1987

Establishment of the Development Unit for Welding Techniques and Nondestructive Testing (UDTSCND)

1992

Foundation of the Scientific and Technical Research Centre of Welding and Control CSC by Decree 92-280 of July 6th, 1992

2003

Foundation of a Public Institution for Scientific and Technical Character (EPST) by the 03-461 decree of December, 1st 2003

2015

**Creation of
Research Center in
Industrial
Technologies**

CRTI
2012

Establishment of the Thin Layers Development and Application Unit (UDCMA Setif)

2010

- Foundation of the Research Unit for Industrial Technologies (URTI, Annaba)
- Establishment of the Technological Platform (Bousmail)

2009

Creation of the subsidiary CSC-Expertise SPA (Bou Ismail)

2005

Attachment of the Applied Research Unit for Steel and Metals (URASM - Annaba)

CRTI Flowchart

Director General

Quality Management Service

Deputy Director

Secretary General

Research Units

Advanced Materials Research Unit (URMA)

Iron and Steel Research Unit (URASM)

Thin Films Development and Applications Unit (UDCMA)

Research Divisions

Characterization and Instrumentation (DCI)

Signal Processing and Imaging (DTSI)

Electric and Magnetic Processes (DPEM)

Metallurgical and Mechanical (DMM)

Welding and Related Techniques (DSTC)

Corrosion Protection and Materials Durability (DCPDM)

Technical Departments

External Relations and valorization of research's results

Monitoring of Scientific and Technical Activities

Quality and Radioprotection

Common Departments

Mechatronic Technology Platform

Thermal Spraying Technology Platform

Metallurgy Steel Technology Platform

Analytical Calibration and Measurement Workshop

Testing, Analysis and Simulation Workshop

Subsidiary CSC expertise SPA

Administrative Departments

Staff and Training
Budget and Accounting
General Resources
Internal Security Office

DIVISION OF WELDING AND RELATED TECHNIQUES

Missions

Welding has changed from an art to a science applying “high-tech” technologies and several transversal axes from which several Related Techniques emerge.

The Division of Welding and Related Techniques aims at the development of technological innovations that will expand welding’s presence in the manufacturing sectors. Research orientations in the Division of Welding and Related Techniques go from arc initiation, arc diagnostic and welding arc control to the phenomena governing the metal fusion as well as the metal solidification by going through several automation and synergy steps which are necessary to better understand the welding phenomenon.



The main research themes in DSTC are about:

- Welding plasma diagnostic and spectroscopy.
- The command and control of welding’s installation.
- Material behavior at high temperatures.
- Industrial environment of welding process.

DIVISION OF CORROSION, PROTECTION AND DURABILITY OF MATERIALS

Missions



Corrosion of materials in industrial environments is a major factor limiting their lifetime. It affects many structures, especially metallic ones, which causes many replacement costs and lost productivity, and sometimes results in catastrophic damage (human damage, environmental pollution , etc. .

The cost caused by corrosion, which covers all means of struggle, replacement of parts or structures corroded and the direct and indirect consequences of accidents due to corrosion is estimated at 2% of national product. About these costs could be avoided if prevention technologies of existing corrosion were properly implemented. Corrosion of infrastructure is an ongoing problem . In order to prevent or minimize corrosion this division is charged to implement the necessary research programs to the development of the techniques related to corrosion process and anti-corrosion by the active and passive methods.

It aims to:

- Study and master the phenomena and the mechanisms of corrosion in materials;
- Master the techniques of simulation of corrosion processes and their validation practices;
- Control and develop the anti-corrosion protection processes;
- Control and optimize the active protections systems against corrosion.

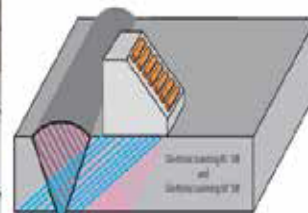
DIVISION OF SIGNAL PROCESSING AND IMAGERY

The mission of this division is to develop and implement signal and image processing-based techniques to be applied in the nondestructive testing (NDT) field. In particular, its objectives are the development of systems permitting the automatic acquisition of one-dimensional or multidimensional signals, their processing, as well as their visualization or the reconstruction of 2D or 3D images and finally, their interpretation using image analysis and pattern recognition.

Missions

The developed themes are:

- Processing techniques applied to NDT methods.
- Ultrasound and x-rays.
- Automation of NDT methods.
- Artificial intelligence in NDT.
- Advanced techniques in NDT.
- Tomography, guided waves and acoustic emission.



DIVISION OF CHARACTERIZATION AND INSTRUMENTATION

This division is in charged by characterization of materials from the point of view of the physical and mechanical properties using non-destructive methods such as acoustic waves and ionizing radiation.

The topics currently developed are:

- Ultrasound (Volumetric waves, Guided waves, Lamb waves);
- X and Gamma rays;
- Ultrasonicsensors ;
- Mechanicalspectroscopy of materials ;
- Studies of acoustic wave propagation phenomena in materials.

The division has established a calibration laboratory for NDT equipment's for the industry. This laboratory, which is being accredited according to ISO /17025, aims to verify and calibrate NDT equipment (ultrasonic devices, ultrasonic thickness gauges, sensors, densitometers, Eddy current equipments and X-ray generators).

Missions



DIVISION OF ELECTRICAL AND MAGNETIC PROCESSES

Missions

The DPEM division develops non-destructive methods using electrical, electromagnetic and optical processes. These methods are applied to the characterization and evaluation of materials (structure, defects, ...) and coatings. In addition, it examines and optimizes hardware and software relating to testing techniques using methods such as eddy currents, microwaves, Barkhausen Noise.... One aspect of characterization of nanostructures is performed by the hysteresis loops with high sensitivity.



Teams in this Division are also interested in the characterization of different types of materials by techniques of vibrational spectroscopy, especially Raman and Infrared spectroscopy. To use these complementary techniques would determine very interesting optical properties (optical gap, refractive index and absorption coefficient ...), and highlight the types of possible optical transitions. Another objective of our teams is to use different non-destructive optical techniques as for the characterization of electronic and optical properties and evaluation of materials and their interfaces, such as spectroscopic ellipsometry, optical microscope experimental methods and reflectometry, by examining the revelations observed by micro structural changes in molecular materials.

DIVISION OF METALLURGY AND MECHANICS

Missions



The main role of this division is to perform a multidisciplinary research on relationships «Processes – Microstructure – Usage Properties» of materials.

The main research themes are about:

- Textures and microstructures evolutions during the fabrication processes of metallic alloys;
 - The thermal, metallurgical and mechanical phenomena induced in materials during welding operations and their effects on the mechanical behavior of welded joint;
 - Modeling of thermomechanical behavior of materials and assemblies. Microstructural heterogeneities occurring in a material at different manufacturing processes (elaboration, forming, welding ...) often are sources of strain incompatibility and become sites for damage initiation. Knowing the "microstructure-properties" relationship, we can progress in the dimensioning to the rupture or predicting the lifetime of parts for various loading and operating conditions. A better understanding of the parameters that control the materials structure allows undertake on modeling their behavior in order to predict their useful service life.
- These studies serve to develop prediction methods of materials properties, in a way to provide helping tools to the definition of procedure's operating modes to implementation of these materials and sizing the welded structures.

ADVANCED MATERIALS RESEARCH UNIT

The Unit of Research in Advanced Materials (URMA) is attached to the Research Center in Industrial Technologies (CRTI) in March, 15th 2011 by Ministerial Order no 144. This unit is responsible for research and development activities in the field of advanced materials. Accordingly, it is responsible of :

- Respond to socio economic needs through development of prototypes, models and systems associated with its domains, in addition of attaching a particular importance to technology transfer;
- Develop research themes in the field of electrical system engineering and control of processes;
- Develop themes directly into the field of materials for extreme use, mechatronics and industrial maintenance;
- Industrial technology maintenance;
- Modelling and simulation of systems and processes;
- Ensuring the expertise of industrial facilities and their staff training in order to improve production processes and increase their competitiveness.



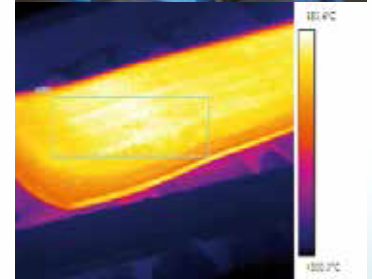
IRON AND STEEL APPLIED RESEARCH UNIT

The Iron and Steel Applied Research Unit aims at conducting research for the control of the scientific and technological development in iron and steel through undertaking studies to:

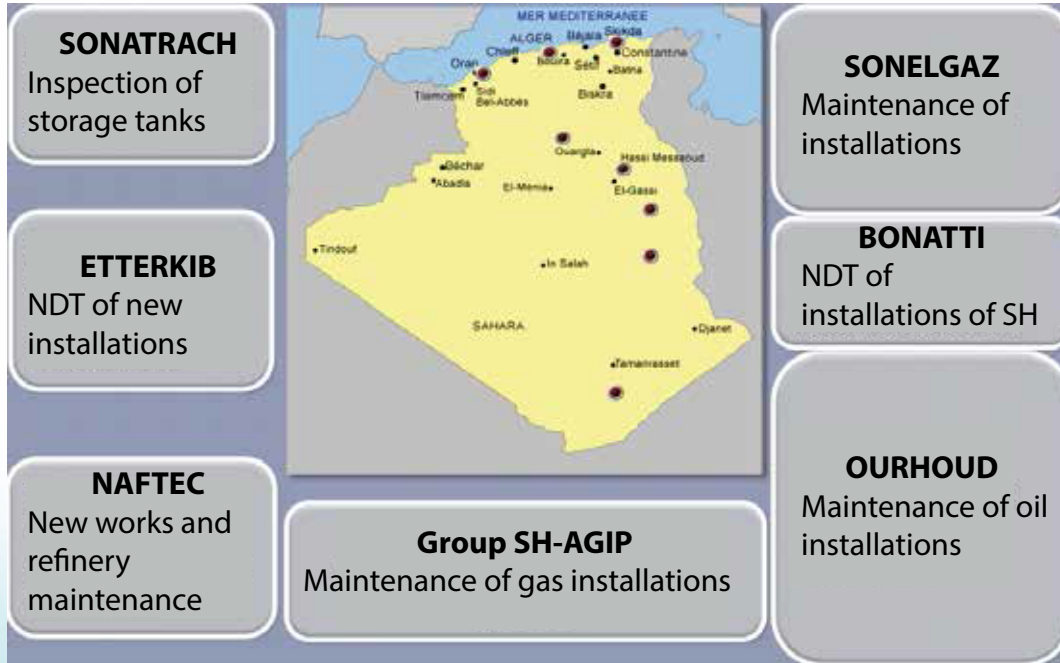
- Develop new products, processes and systems in the fields of iron and steel technology (material preparation, melting –solidification and liquid –solid forming);
- Physical Metallurgy;
- Develop new techniques, methods, models and software;
- Modeling and simulation of siderurgical and metallurgical processes;
- Characterize and measure the quality of products and processes.

In addition to its mission to boost the scientific progress, the unit aims at performing support services to the siderurgical, metallurgical and mechanical industries through:

- Expertise in the field of metallurgy and related technologies;
- Training in the field of steel technology (production processes, product characterization, measurement, etc. ...);
- Physico-chemical Analysis (the laboratory has been accredited according to ISO CEI 17025);
- Mechanical testing (the laboratory has been accredited according to ISO CEI 17025).



Socio-Economic Impact



CRTI , through its Common Services, (CSC) Expertise Spa subsidiary and workshops contributes to the national industry in the areas of inspection, expertise, skills training and support for companies in terms of the quality process as repositories ISO regulations.

The subsidiary CSC Expertise Spa, 100% ownership of CRTI is the only company according to the higher education and the scientific research sector accredited according to ISO 17020. It activates in national territory and represents a key partner of national strategic companies (SONTRACH, SONELGAZ) and multinational companies.

Technological Platform of Bousmail

Presentation:

The Technological Platform of Bousmail (Tipaza) contributes to the creation of a dynamic exchange as well as a scientific and technological collaboration between research structures of the center and the different actors of the socio-economic sector. It ensures through its teams of specialized engineers a transfer of knowledge to the benefits of the national industrial sector.

Missions

- A space for qualifying training and development devoted to the socio-economic sector staff.
- An incubator for the realization of structuring and innovative projects.
- A link of demonstrations, training as well as supervision of PhD students.
- A Space of realization of noble missions.



Welding and Mecahanics Workshop

Workshop activities



The Workshop of Welding and Mecahanics conducts researchs and development in relation to the themes developed in the center through multi-skilled teams. It is a common service-fold mission of research and provision in favor of the socio-economic sector.

It consists of 02 laboratories, a department and a quality section.

The workshop is also a support for research and training in technical assembly and mechanical manufacturing.

Simulation Analysis and Test Workshop (URASM)

Workshop activities

The workshop is a joint service that has a dual mission , research mission and delivering mission in favor of the socio-economic sector.

The workshop consists of six (06) laboratories and quality section :

Laboratories:

- Mechanical testing laboratory.
- Chemical analysis laboratory.
- Corrosion Laboratory.
- Measurement for industrial control laboratory
- Laboratory of metallography and heat treatment.
- Physical testing laboratory.
- Quality section



Testing, Characterization and Measurement Workshop

Workshop activities

The workshop of testing, characterization and measurement is dedicated to support researchers to carry out scientific research in different domains developed at the research unit in advanced materials. It allows also researchers, teachers and students to conduct their research and also to carry out work for the socio economic sector. Furthermore, the workshop is composed of two laboratories:

- Non-metallic materials Laboratory
- Mechatronics Laboratory



Calibration, Analysis and Measurement Workshop

Activities



With an experience of twenty years in the field of Non Destructive testing instruments, the CRTI aim is to establish a workshop dedicated to the calibration and characterization activities in the field of NDT and Metrology, along with material tests and analysis. The workshop is composed of two laboratories:

NDT Calibration and Verification Lab

The NDT Calibration and Verification Lab offers calibration and verification services for the inspection bodies operating in Algeria which use NDT instruments and have to maintain work ethic standards of high quality standards.

After undergoing a pre-assessment by the national accreditation body ALGERAC, the lab is actually being supervised by experts mandated by the European Union with a clear objective which is to accredit the lab activities according to the ISO/CEI 17025 standard. The scopes of this accreditation process are: ultrasonic testing instruments, transducers and thickness gauges.

Metrology Lab

This laboratory is responsible for the calibration, verification and adjustment of test and measurement equipment in the temperature range and especially the pharmaceutical and food processing.

CSC subsidiary SPA Expertise

Accredited according to ISO 17020 norms



Areas of intervention

- Work inspection and supervision
- Expertise
- Non Destructive Testing (NDT)
 - Radiography X and Gamma
 - Ultrasound
 - Penetrant testing
 - Magnetic testing
 - Eddy currents
- Qualification of welding procedures and welders
- Mechanical and fatigue tests
- Cathodic protection
- Corrosion measurement and soil resistivity
- Study and monitoring of achievements

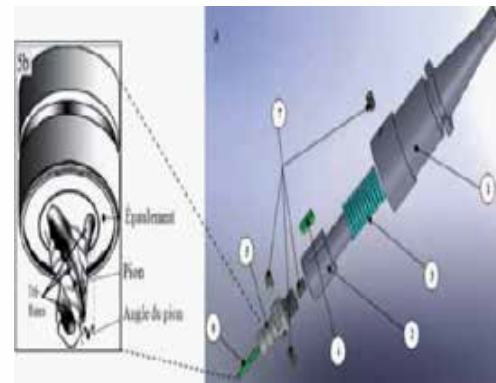


Research results valorisation

Invention patents

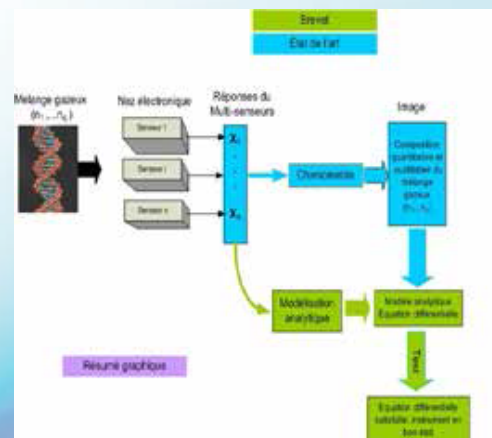
Welding friction stir tool (FSW) 2007

The friction stir welding is an enhancement relating to friction welding. The first patent for this technology, which was introduced by Thomas Wayne, has continued to develop during the six years that follow. According to the database, this welding technology does not yet exist in the industry of our country; in 2007 the realized tool was patented at the National Institute of Industrial Property (INAPI).



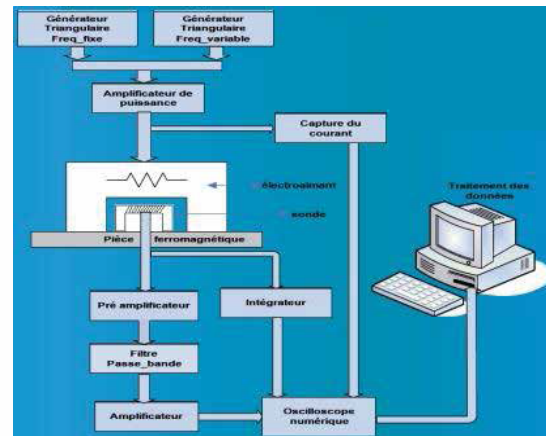
Verification procedure of the proper functioning of multi-sensor chemical gases to 2010

Gas chemical multisensory are electronic devices that can be used to detect the gas particles, analysis of the gas mixtures and identify odors. Like all electronic devices, they are subject to abuse. To avoid false steps, these devices must be calibrated regularly. Therefore, it has been proposed analytical models that describe the stationary interaction between an electronic nose and a gas mixture, connecting the concentrations of mixture components to partial sensitivities of the sensors, which have verify and test the operation of the elements multi-sensor, which has continued to develop since 2010 in the Research Center in Industrial Technology CRTI.



Realization of a Barkhausen noise meter and a hysteresis tracer 2010

The objective of this patent is to produce a device for Barkhausen noise acquisition to evaluate the behavior of materials, subjected to magnetic stresses by the plot of the hysteresis loop and to determine the magnetic properties of ferromagnetic materials. This determination will evaluate the microstructures of materials from electrical and magnetic data calculated.



Realization of a welding machine Friction Stir 2015

CRTI has launched the development of new techniques such as friction stir welding. Currently the work focuses on the design and production of a machine capable of meeting the wide beaches of welding parameters required by the FSW process, which it will introduce this process in various industrial sectors.





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Research Center in Industrial Technologies

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INFO CRTI

The content of this booklet is devoted to Research Center in Industrial Technologies CRTI. It presents succinctly missions, objectives and organization of the center. Its purpose is to highlight the involvement of CRTI in the industrial world and its important contribution in the field of scientific research and technological development in our country.

CRTI/2016