



## ISIM MISSION

To perform high quality activities of applicative research and technological development, respectively of qualification, certification, examination and inspection services, bench tests, welding consultancy, connected procedures, material and welded structures testing in order to increase Romanian industry efficiency and competitiveness.

## RESEARCH DIRECTIONS AND OBJECTIVES

The research directions and objectives are rising from the institute's mission. The importance of them has changed during time in correlation with the Romanian industry needs, which was in continuous adaption process to the needs of European and international economic environment.

The main research and development directions of the institute are:

- Fundamental research in the field of welding and allied processes
- Fundamental research in the field of material testing
- Applied research in the field of welding, allied processes and material testing
- Welding with concentrated energy beams (laser, electron beam)
- Welding with unconventional and hybrid procedures
- High productivity welding and cutting procedures
- Material behaviour in heavy mechanical and thermal load
- Development of new materials by thermal spraying
- Rest life evaluation of welded structures

Now the importance of fundamental research is reduced while the applicative research asked by industry is higher. New welding technologies using concentrated energy beams (laser), with friction stir welding (FSW) or ultrasound welding takes a more important place in the research projects. In the field of material testing it is necessary to amplify the research of materials working in heavy loaded conditions especially in connection with the energetic, chemical and petrochemical plant aging in the Romanian industry. Research was developed for the rest life evaluation of components of these equipments and for the first time in Romania the method of risk based inspection and maintenance (RBIM) was introduced.

The main objectives of research and development of ISIM are:

- Development of modern welding technologies applicable in automotive industries, construction of welded structures, power and chemical equipment etc.
- Development of technologies for inspection and examination of welding processes and welded products in order to optimize and increase the competitiveness of industry in Romania.
- Introducing or expanding widely in Romanian industry of new performance welding processes in terms of economic, energy and environmental protection such as ultrasonic welding, concentrated energy beam welding and friction stir welding (FSW).
- Testing and development of hybrid welding processes.

- Introduction to the economic environment of the country of modern inspection procedures fitness -for- service ( FFS ) and risk based inspection ( RBI ) leading to significant user savings.
- Development of technologies combining new and advanced materials (shape memory materials, amorphous materials, metal matrix composites) using laser beam and ultrasonic welding.
- Development of high productivity cutting processes applicable to both metallic materials as well as non-metallic materials using abrasive water jet cutting.
- Characterization of new and advanced materials in terms of structural and mechanical properties.
- Evaluation of the possibility of using renewable energy in welding processes.
- Using thermography to monitor welding processes and NDT.
- Development of technologies for the production of thermal spray coatings for corrosion protection of metal and ceramics, decorative elements, anti-wear layers and thermal barriers.
- Development of new materials such as metal -ceramic thermal spray.
- Development of technology transfer dedicated custom welding equipment for specific applications from different economic agents.
- Development of ultrasonic welding equipment for specific applications required by national and international customers.

## MAJOR PROJECTS REALIZED IN THE INSTITUTE

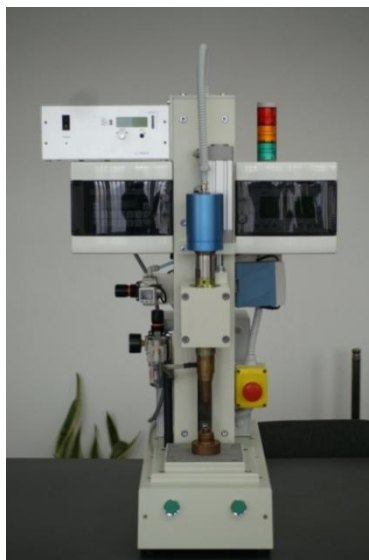
### a) Specialized ultrasonic hybrid spot welding equipment ESEPUS 02

The hybrid welding equipment that combines electric spot welding with ultrasonic welding is a novelty design and has been developed in a project with SLV Welding Institute in Munich, Germany which called for delivery of the instrument through a contract.

The project objectives were:

- Creating a device that combines into a hybrid system **two different welding processes**, namely electric spot welding and ultrasonic welding.
- Driving the two processes through a controller so that the **welding parameters can be freely and independently adjusted**
- **Control of both welding processes** so that they can be carried out simultaneously or successively in any order and adjustable time.

The equipment is based on a new concept for the development of innovative technologies with applications in various industries, i.e. electronic, electrical, automotive, etc. The process is highly productive and has an ecological character.



The equipment was delivered and commissioned at the Welding Institute in Munich Germany. Currently the device is used by the German Institute in their research activities.

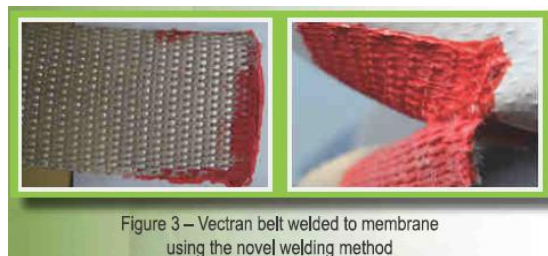
## b) CONTEX-T: Textile architecture - textile structures and constructions of the future

IP-SME FP6 project, with a budget of € 10 million, coordinated by CENTEXBEL and Belgium BEXCO, had as its main objective "total remodelling and redesign of the <<value chain >> of permanent or temporary textile construction and structures by developing new high performance technical textiles materials" was developed in a consortium of 30 partners from 10 EU countries, completed in August 2010.

The project objectives were:

- Development of **lightweight construction using textile structures** with a lifetime of up to 60 years, constructions that meet the requirements regarding noise reduction, sound absorption, thermal insulation, transmission and reflection of light.
- **Development of safe buildings**, healthy, economical and comfortable for dwellers.
- Quick and easy construction of **custom buildings and structures**

ISIM Timișoara has contributed to achieving the project objectives by developing new methods of combining the materials used and developed in the project.



## c). Development of new and innovative techniques for joining heterogeneous materials by Friction Stir Welding

The project was coordinated by ISIM Timisoara, being made in the PN II Program, in partnership with the University Politehnica Timisoara (UPT), the University Dunarea de Jos of Galati (UDJ) and Romanian Welding Society (ASR).

The project's main objective was own contribution to the development of FSW process:

- Process and device stir welding - **FSW-TIG hybrid welding** (patent No. RO 123 349 B1, granted by OSIM Bucharest at 28.10.2011), resulting in increased welding speed by about 80% and increasing the duration of tool life by 50%.
- Development of a friction stir welding device for **welding of hard aluminium alloys** (patent application no. A01277/06.12.2010).
- Online monitoring of the welding process using infrared thermography



- Achievement of functional layers with a consumable tool, (using the FSW principle), patent application no. A01278/06.12.2010
- **Modelling of the hybrid welding process** with additional heat input (FSW-TIG); modelling of the FSW surfacing with functional layers
- Development of a complex FSW system having role of the **technological demonstrator for industrial applications.**
- Tools and welding technologies for joining of the **heterogeneous light metals**

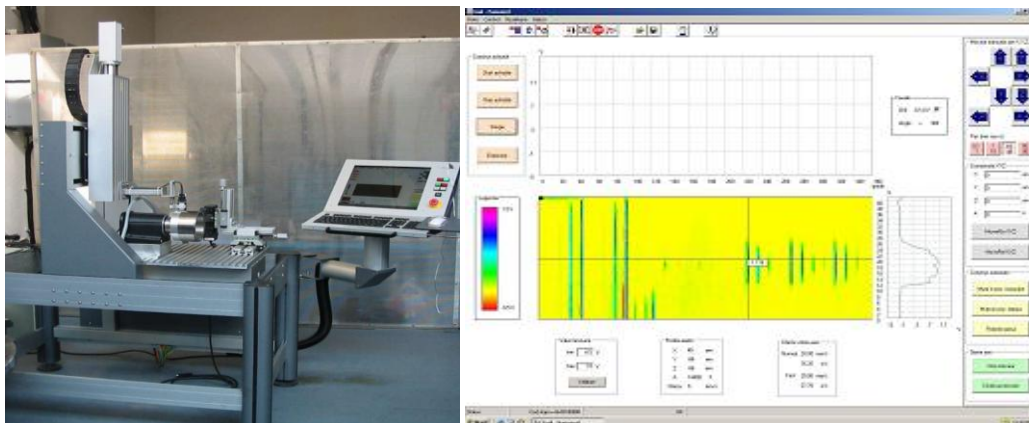
**d). Automatic non-destructive examination system for rail safety components based on nano-structured magnetic sensors**

The project was conducted in partnership with CEEX Program IFT Iasi, ICPE-CA Bucharest having as industrial beneficiary the CFR Grivița Workshops, Bucharest.

The project objectives were:

- Development of a new generation of string sensors (multiple sensors) using the active medium a nanostructured material for applications in low magnetic field
- Development of an **original system in terms of precision mechanics** of application / movement of sensors and computer controlled rotation of the work piece,
- Development of a **computer control system for a complex equipment** with mechanical drives and data acquisition / processing
- Creating a **powerful control and data processing software**, with high value of usage in other applications

The equipment, currently in operation at CFR Grivița Workshops, Bucharest was displayed at TIB and at the important Industrial Fair in Hannover Germany.



**d) Flexible & modular fixture solution for high performance welding technologies**

FLEXYWELD, a MANUNET project, with SME's from Italy, Spain and Romania, focused on the laser beam welding applied in automotive industry, a technology with a rapid development that

guarantees thin esthetical welds, reduced thermo-mechanical effects onto the welded components, short execution times (high speed process), one-side accessibility and exploitation flexibility, a process that requires the **designing and realization of special clamping units**. Clamping units can be standard or special; “special” means built “ad hoc” and it will be one of Flexyweld objectives, to study and realize flexible and modular clamps which are able to adapt themselves on different metal sheets shapes (every car type has different metal sheets shapes).

**Main objective:** improving the **laser beam welding process** (applicative technologies for new types of steel, including Zn-coated ones), process cost reduction and increasing its flexibility and its (auto)- adaptability.

The activities of the Romanian partners are focused, mainly, on **developing and optimization of pulsed laser beam welding technologies** for the specific materials as well as the development, at a principle level, of a process control method.

