Publishable summary

"MACHINE FOR MICROPARTS MOULDING BASED ON ULTRASOUND EXCITATION" SONO"R"US

SONO"R"US Objective:

- The aim of the **SONO"R"US** project is the **improvement, optimization** and **industrial implementation of a pre-commercial moulding machine for the production of plastic parts in the micro and mini scale size**, allowing the redefinition of the key features of the prototype developed under the SONOPLAST project.

- Once the technical improvements are implemented, the new machine is tested in **a real industrial environment**. In addition to the technical developments, and as a parallel issue, a **study on some possible new markets** is carried out. The goal here is to assure that the solutions fully comply with all the requirements of the identified key-sectors.

In order to achieve the expected results, the structure of the work plan has been focused on:

1. **Optimization of the prototype/machine** by using technical criteria and relevant data parameters analysis.
2. **Development of a pre-commercial machine:** developing of 2 pre-commercial Machines (Machine1 & Machine 2) for reaching a complete validation of the technology, guarantying a proper introduction to the market.
3. **Validation** of the first machine (Machine1) for an expert **industrial laboratory**.
4. With the best options (technical/cost analysis) from Machine1 tests, Machine 2 fulfils the necessary requirements to be **tested in industrial conditions** at full capacity.

Work Performed and Results Achieved:

During the SONO"R"US project, four main activities have been carried out:

A. Mechanical optimization and external units coupling:

- Mechanical and physical enhancement and integration of different external units to the machine´s frame.
- Redesign of the main framework.
- Recalculation of machine structure, forces and improvement of the system guidance.
- New feeding system with higher accuracy, and with an easy access for cleaning, adjustment and material exchange.
- Redesigned of the ejection system.
- Mold reconfiguration, adapted for a correct molding process.

- Pick & place system with pneumatic grip or suction system and fully integrate with B&R control.
- Integration of double safety system, one that prevent automatic machine operation while door is open and other that allow working with the machine cover open in manual mode (to avoid the opening and closing of the cover each time)

B. <u>Develop of an enhanced control system:</u>

- Improvement of the control system, mainly focus on the development of new control strategies and the optimization of the cycle´s time, repeatability, flexibility and performance.
- One of the main innovations is the control by velocity, which ensures an accurate pressure profile to cope with material requirements.
- Along with the velocity profile it is possible to introduce amplitude values for the ultrasonic vibration.
- New HMI interface (Human Module Interface) that permits the user to adjust the machine in real time and that incorporate a process trend window (tool to analyzed data from the process)
- Information can be retrieved by an FTP connection (File Transfer Protocol) that allows storing data cycle by cycle in a main server for later analysis and quality control.
- Final version of the software also includes a data base to store variables, material properties and setting for every mould tested.

C. <u>Machine testing within an industrial environment:</u>

- The lab machine (machine 1) and the pre-industrial machine (machine 2) have been exhaustively tested in different partner facilities and during de Beta tester program, in real working conditions.
- The pre-industrial machine validation was done according to a predefined check list
- As result of the different tests it has been designed the Full industrial machine (SONORUS 1G)

D. <u>Adaptation of the machine for customization in potential fields:</u>

- It was carried out a technological feasibility study to evaluate the introduction of the technology into new markets.
- Several applications were proposed base on the effect of the ultrasound effect on a given media (material). The field of application goes from the sonochemistry to the cleaning process.
- The machine has been modified to accomplish C.E. mark, to be safe and fast, and also has been improved to ensure the stability of the molding process, optimizing the sonotrode movement, the feeding system and the control system.

<u>Final Results:</u>

- Under the umbrella of the SONO"R"US Project, it has been developed the **first commercial moulding machine based on ultrasounds**, called **SONORUS 1G**.

- Within SONO"R"US project, SONORUS 1G went through an **industrialisation process which led to its validations and market launch**. Moreover, several enhancements have been made to fulfil market needs as well as improving market uptake.

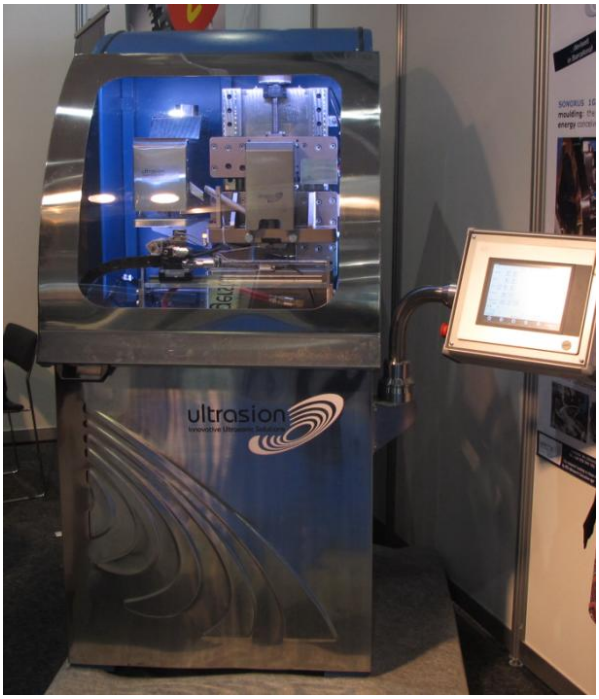
- Experts within the project have integrated into SONORUS 1G a **variety of control options for the automation of the process and optimisation of a wide range of product needs**. Today the machine is using the **latest and greatest software routines** to deliver plastic parts with high precision and performance. It also uses **protected close-loop sequences** that ensure the correct plastic moulding conditions. Finally, SONORUS 1G has **improved its existing connectivity** options in order to monitor accurately the traceability of the process.

- SONORUS 1G is highly reliable and energy efficient – up to **90 times lower power consumption** compared with traditional injection moulding technology-. Since no electrical heaters are needed, the **process is highly energy efficient** while putting the thermoplastics under a much lower risk of degradation, being ideal for production in white rooms and labs. Additionally, our low stress process involves a reduction in tooling costs estimated between 25% and 35%.

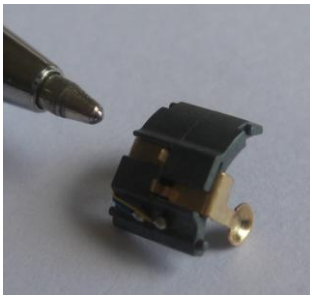
- In the early 2012, a **Beta Tester programme** was carried out according to SONO"R"US Project plan with the aim of **integrating added-value improvements to make SONORUS 1G** machine more competitive. One of the main purposes of the pilot test was to collect information and advice from participants (industrial companies, universities, labs).

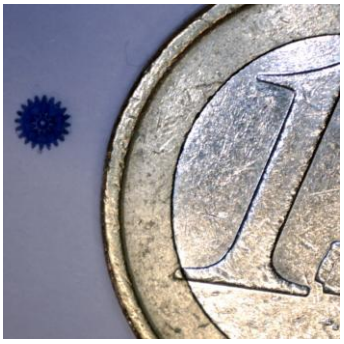
- The Beta Tester programme gave us the **chance to explore the potential markets**. For instance, **medical** is now one of the targeted markets because plastic micro and mini parts are required with high precision and material no degradation such as catheters parts, hearing aid devices components, and dental applications. Our new revolutionary manufacturing technique has **proved efficient and potential medical companies have already expressed their interest in acquiring the machine**.

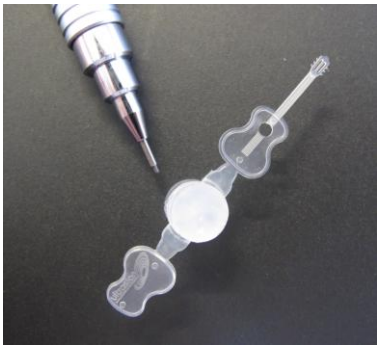
- Another example is the **electronics industry**, especially when it comes to **overmoulding of micro-component parts**. This has also resulted in another significant target market since our ultrasounds-based manufacturing process entails an important reduction in raw material consumption (no degradation, no waste in purging barrels, smaller sprues and runner systems…) which leads to saving costs.



Final SONO”R”US MACHINE (SONORUS 1G)







Produced parts with SONO”R”US technology: Medical and precision mechanic sectos

Other information:

Project Public Website:

www.sonorusproject.eu

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List of participants:

Participant Nº	Participant name	Organization	Country
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2	Promolding	SME	Nederland
3	Cedrat Technologies	SME	France
4	Ultrasion	SME	Spain
5	Fundació Ascamm	RTD	Spain