PUBLISHABLE SUMMARY (PROJECT PERIODIC REPORT)

Grant Agreement number: 315506
Project acronym: SOUNDCAST
Project title: “Vacuum-assisted high pressure die castings with reduced porosity at low cost”

Funding Scheme: FP7-BSG-SME
Date of latest version of Annex I against which the assessment will be made: 30/10/2012
Periodic report: 1st ☑ 2nd ☐ 3rd ☐ 4th ☐
Period covered: from 1/11/2012 to 31-07-2013

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¹ Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.
² The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

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A summary description of project context and objectives (4000 characters including spaces)

The necessity of preserving resources and to reduce environmental pollution makes light weight concepts and recycling highly interesting for the transportation market, being light weight essential for newly developed electric and hybrid vehicles.

At the present, the use of aluminium high pressure die castings for structural applications in the automotive industry is limited due to the presence of porosity inherent to the fabrication process. High vacuum processes can reduce porosity significantly, but both the capital investment and the process costs are very high.

On the other hand, the use of cheaper adaptable vacuum systems it is still not very popular in SME foundries, despite of significant technological improvements during the last years; this is mainly because of the complexity of this process, the need for improved process stability and deeper metallurgical knowledge of the alloys used in these new applications.

The aim of the SOUNDCAST project is to provide the SME die caster with an innovative and environmentally friendly technology to produce sound and weldable high performance castings by a low cost vacuum assisted high pressure die casting (VPDC) process. The optimized fabrication technology, Soundcast technology, must be capable of economically producing large, thin walled and complicated components with recycled aluminium alloys having minimal porosity, excellent mechanical and welding properties.

This makes necessary to take into account all the factors affecting casting quality which interdependence is shown in Figure 1. Technically, the first and major step is clearly to master the different aspects related with vacuum technology applied to HPDC. The link between the most important parameters that enhance porosity is established during the project and a versatile technology package (“Soundcast Technology Package”) which optimizes the whole fabrication process is developed including:
- Numerical simulation of die filling and solidification
- Special die design
- Use of a “state of the art vacuum” valve
- HPDC process parameter optimization
- Optimized die and shot sleeve lubrication for welding applications
- Development of quality control software
- Development of a new recycled alloy(s) with high mechanical properties
- Melt and heat treatment optimization for the new recycled alloy(s)
- Development of a new laser welding process at reduced pressure

The developed know-how and technologies will be demonstrated and validated in two SME foundries: ALIASA (Spain) and DIACE (France). ALIASA foundry coordinates the project and will perform the demonstration activities related with the fabrication of a weldable high pressure die casting demonstrator, while DIACE foundry will perform demonstration activities related with the fabrication of a demonstrator with high mechanical properties.

The vacuum valve fabricant VDS (SME from Switzerland) and die lubricant supplier ChemTrend are enhancing their competiveness by demonstrating the effectiveness of their products, leading to enhanced confidence of the clients and strengthen their market position. Its technological advice in
all aspects of vacuum technology and die lubrication is absolutely necessary for reduction of porosity with regard to the application of heat treatment and/or welding process to the VPDC castings.

Figure 1: The SOUNDCAST project takes into account all the factors affecting the casting quality.

Figure 2: Consortium of the SOUNDCAST project and relevant contact details.
A description of the work performed since the beginning of the project and the main results achieved so far. (4000 characters including spaces)

PROJECT MANAGEMENT: The project management structure has been built up. Responsibilities of each partner are clearly defined and responsibilities for each working area are named. Financial guidelines, procedures and financial plan have been developed, as well as procedures for the consortium reporting activities, templates, etc. An intensive follow up has been done.

PROJECT COMMUNICATION AND IPR MANAGEMENT: Since the beginning of the project the rules for internal and external communication were set. Also the IT tool for internal communication, and IPR control, was set up and it is intensively used by the consortium (all documentation generated in the project is contained in this application). Interim Plan for use and dissemination of the knowledge is done. A web page was created in month 3 and is periodically updated. A draft dissemination plan has been developed in order to make the developed know-how available for the companies possibly interested in this new technology.

R&D COORDINATION: An intensive and exhaustive R&D coordination/supervision of the technical activities and its quality, according with the work plan has been carried out. This activity was always coordinated and monitored with the project coordinator. The main R&D results are listed below:

FABRICATION OF A DIE for the test pieces FOR EVALUATING MECHANICAL PROPERTIES of the new proposed alloy and VPDC process is done. A test piece with 6 steps of different thicknesses: 1, 2, 4, 6, 10 and 15 mm has been selected for determining the mechanical properties.

POROSITY in the VPDC PROCESS IS SIGNIFICANTLY REDUCED by:
- the use of SIMULATION TOOLS (numerical simulation of die filling and solidification) for correct application of vacuum and die design (100% done)
- OPTIMIZATION OF THE HPDC PROCESS PARAMETERS is conducted on a three stage process: the injection curve during the first phase, optimal velocity of the second injection phase, compacting pressure on the third phase of injection (90% done)
- the USE of a special VACUUM SYSTEM has been implemented in the testing die and the results obtained on the trials are satisfactory (70% done)

A NEW RECYCLED ALLOY WITH IMPROVED MECHANICAL PROPERTIES BY MICROALLOYING has already been developed. The chemical composition of the new recycled alloy has been formulated. Alloying and microalloying was based on the economical benefits, the need to fulfill the market constraints, avoid sludge formation and die solder.

MELT TREATMENT OPTIMIZATION OF THE NEW RECYCLED ALLOY was carried out. A process Flow Chart for the melt treatment of the new alloy is defined, including adequate quality controls.

A MELT QUALITY CONTROL SYSTEM is already available, based on a software that allows to predict Si modification. The predictions are valid for the conventional primary AlSi10MnMg alloy and the new developed secondary alloy.

A FULLY AUTOMATIC DIE SPRAYING SYSTEM IS SELECTED for the fabrication of sound and weldable vacuum-assisted VPDC components. DIE LUBRICANTS ARE SELECTED based on its influence on the porosity and weldability of cast parts, and also on its release and lubrication performance. The selected lubricants represent an extreme case of high and low wax content.
FABRICATION OF A DIE for the test pieces FOR EVALUATION OF LUBRICATION APPLICATION AND WELDABILITY INFLUENCE is done. A square sheet of 4mm thickness is selected.

OPTIMIZATION OF DIE LUBRICATION AND HPDC PROCESS PARAMETERS of the test piece for welding applications is already done. The parameters of the spraying process and HPDC parameters are optimised, depending on the release agent composition in order to guarantee a hydrocarbon input into the casting structure, which is as low as possible.

In the last month two tasks have just started:
- STATISTICAL TECHNIQUES of the process parameters are being applied with the aim to identify the most relevant ones for forecasting the casting quality
- The HPDC PROCESS PARAMETERS have been started to be optimized to fit the requirements of the NEW RECYCLED ALLOY MELT TREATMENT and its casting behaviour

A description of the expected final results and their potential impacts and use (including socio-economic impact and the wider societal implications of the project so far). (4000 characters including spaces)

The automotive industry has always been very rooted in Europe and nowadays, vehicle manufacturers have production facilities in almost all the Member States. That's why is not surprising that one third of the 50 million cars produced globally are manufactured in the European Union. In total, the car industry represents 6% of total European employment.

Thanks to the results of the SOUNDCAST project the market of aluminum components will be extent to lower class vehicles by reducing the cost of VPDC parts with high mechanical property requirements.

This will deliver to the automotive sector high added value, due to the fact that they will be able to reach high standards that were only produced by the expensive high vacuum die casting process; only reserved to upper range vehicles.

Lower class vehicles manufactured in Europe will be able to reach high quality technologies with better mechanical properties that will be very useful to compete against the strong Asiatic competence. It is a fact that the casting sector in Europe is clearly losing competitiveness against low cost countries.

The HPDC Industry will get important benefits from the SOUNDCAST project in terms of:
- Technological excellence: Thanks to the highly innovative SOUNDCAST procedures for the fabrication of high quality parts by VPDC process, the HPDC industry will be able to open new markets (upper range vehicle manufacturers). Also new welding opportunities will be available.
- Low cost: The cost of the VPDC parts will be reduced as not expensive high vacuum die casting processes and primary alloys will be used. This will be an important added value to the industry as they will be able to produce high mechanical property parts (reduced porosity) at low cost.
HPDC today accounts for approximately 60% of the total production of aluminium castings. Around 80% of the HPDC sector’s SME could benefit by this cost reduction and enhanced casting quality due to the knowhow developed in Soundcast project.

Thanks to this project SME foundries, ALIASA from Spain and DIACE from France, are improving the casting quality, gaining new applications in the automotive and aeronautic sector, and producing at lower costs with reduced environmental impact. The combination of these improved technologies will allow increasing the competitiveness of all the consortium enterprises, up to 20%.

The vacuum valve fabricant (VDS: SME from Switzerland) and die lubricant supplier (ChemTrend: HI from Germany) will be able to show that their products are suitable for high vacuum and low porosity applications for automotive parts, thereby enhancing competiveness and strengthening their market position. The technical methodologies developed in the project allow VDS and ChemTrend to give technical support not only in the correct application of their products, but in all issues of the VPDC fabrication process.

Moreover, the use of alternative recycled alloys will not only reduce the fabrication cost but also lead to a reduced energy and CO2 emissions. To produce secondary alloys requires 95% less energy than required for primary alloys. A reduced die solder and increased die life is expected for the higher alloying elements that are usually present in the recycled alloys.

The process stability and casting quality of Soundcast technology casting process will be assured by the development of new innovative control software suitable for low cost VPDC processes. The benefits will be also applied to conventional HPDC process.

Finally, one of the main results of the project is to provide an innovative welding technology for weld seams with few pores, being also economic in series production for welding components fabricated by SOUNDCAST technology.

The address of the project public website: http://www.soundcastproject.eu/