



Towards zero emissions in European ferrous foundries using inorganic binder systems

GREEN CASTING LIFE

Project duration 09/2022-02/2026

Objectives

The LIFE project 6 European flagship ferrous foundries will implement at industrial scale the inorganic binder system on their production process implying major changes, starting with selection of the suitable inorganic binder system, changes in processes and investments in new equipment.

In parallel different sand reclamation methods will be demonstrated. Based on the results obtained, the foreseen techniques will present an outstanding knowledge for BAT technologies participating to tackle environmental problems and to produce greener products to European market.

Actions in 2023

Project actions started with laboratory scale chamber tests by AGH University where total emissions of different inorganic binders available on the market were measured. Later, industrial scale mould was manufactured in order to measure the airborne emissions during casting.



Fig. 1-2. Picture of chamber test arrangements and emission measurements at Spolka Akcyjna Odlewnie Polskie OPSA foundry in Poland.

Project partners Meehanite Technology, Fundacion Azterlan, AGH University and foundry expert Mr. Pekka Kemppainen visited OPSA foundry in April 2023 for chamber test emission measurements. Also the implementation plan for full scale inorganic binder implementation at OPSA foundry were discussed with project foundry expert Pekka Kemppainen and OPSA foundry personnel. In May 2023 Meehanite technology, Fundación Azterlan, Mr. Pekka Kemppainen visited also JEZ-VOESTALPINE foundry and METAMSA foundry in Spain.

Pretests at 6 flagship foundries started in the beginning of 2023. Different inorganic binders were chosen and average 2-4 different inorganic binders have been tested in each flagship foundry. Pretests are still continuing in all flagship foundries. Responsible partners in each country are making the plans with flagship foundries and binder system suppliers who are also supervising the tests. Results and further actions are discussed in the project TEAMS meetings on regular basis.

Project partner SandTeam and Peak Deutschland as inorganic binder supplier partners participated and gave support in the pretests at Fonderie di Assisi (FA Spa) foundry in Italy, Peiron foundry in Finland and JEZ and Metamsa foundries in Spain. Foundryteam and Pekka Kemppainen visited also Peiron foundry for supervising the pretests and to see the new mixer purchased for inorganic binder system implementation purposes.

Green Casting LIFE project flagship foundries

Fonderie di Assisi is an iron and steel foundry producing demanding parts mainly for automotive industry. Typical casting weights are between 10-100 kg. FA Spa tested cores made with hot cured inorganic binder systems by a core sup-supplier. Cores were mounted in green sand moulds before casting.



Figure 3. Cores made of inorganic binders at FA Fonderie di Assisi in Italy.

Peiron is an iron and steel foundry producing parts mainly for the producers of big industrial machines. Maximum casting weight is ca. 5000 kg. Peiron invested a continuous mixer line for the tests with inorganic binders. Peiron has already produced with this mixer ca. 15 tons of moulds and cores by using two no bake type inorganic binders. The casting quality has been comparable with the castings made by their current phenolic Alphaset moulding line.



Figure 4. Pretests at Peiron foundry in Finland and the new mixer for the use of inorganic binder.

JEZ foundry (Voestalpine Railway Systems JEZ) produces mainly different manganese steel crossings and track devices for the railroads. Current moulding lines use organic furan resin systems and silica/chromite sand. JEZ has tested 4 different no bake inorganic binders systems in cores using olivine sand. In the 4 trials, the inorganic cores remain in the metallic part cavity after the shaking out. The inorganic binder producers are modifying their binders and binder/hardener recipes for solving the core collapsibility problems.



Figure 5-6. Pretests at Voestalpine Railway Systems JEZ foundry in Spain.

METAMSA (Metallurgica Madrilená, S.A.) produces a variety of quality steel castings for Spanish and European customers. They already have experience with inorganic binders, as their molding line for castings weighing more than 80 kg has used a silicate (inorganic) binder system for years. Castings of less than 80 kg are made in green sand line. Metamsa's experiences and knowledge of inorganic binders are shared among the flagship foundries while they try to improve the behaviour of the inorganic line in cooperation with binder manufacturers and other project experts.



Figure 7. Pretests at metalurgica Madrilená Metamsa foundry in Spain.

OPSA (Odlownie Polskie S.A.) is a modern iron foundry applying automatic green sand lines and several core making lines, bot hot-box and cold-box lines. OPSA produces all kind of high-quality iron castings (including ADI) for European customers. Largest market is Germany and main customer groups include eg. machine, automotive, energy and heavy rail industries. OPSA has a phenolic Pep-SET line for smalls series and prototypes. With this line pretests have been started. First has been compared the emissions between organic Pep-set and different inorganic moulds by a chamber test.



Figure 8. Picture of OPSA foundry.

Cleaning foundry surplus sands by composting method

In addition to the inorganic binder system implementation actions in the flagship foundries, different surplus foundry sand purification and reuse methods will be tested in order increase the recycling of foundry sand back in foundry processes, to find new reuse applications for inorganic binder system waste sands or “mixed” waste sands with inorganic and organic binder system sands. The aim is to reduce the amount of surplus sand to be landfilled in the future. One of the tested reuse methods is a composting process which was demonstrated in Finland.

Composting tests started in July 2023 in Tampere, Finland. One composting heap representing inorganic binder system waste sands from the pretests from Peiron foundry and the other representing “mixed” inorganic and organic binder system waste sands (green sand). Composting heaps were 15 tons and 22 tons and foundry sand portion average 25%.



Figure 9-10. Cleaning harmful substances of foundry waste sands by composting method (both inorganic and organic binder system waste sands) and producing clean soil material for new reuse applications.

Project meeting at GIFA International Foundry Trade Fair in Düsseldorf in June 2023

Project partners arranged a meeting at GIFA Messe in Düsseldorf on 15th of June. Also meetings with potential inorganic binder system suppliers were arranged to disseminate the Green Casting LIFE project activities and invite new binder system suppliers to participate the pretests.

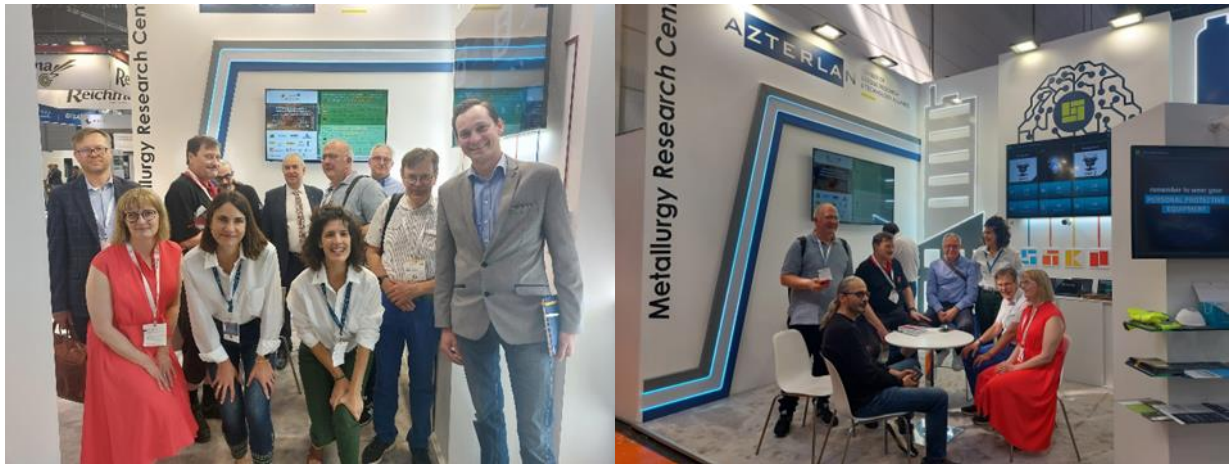


Figure 11-12. Project meeting at GIFA International Foundry Trade Fair in Düsseldorf on 15.6.2023

IV International Conference of Casting and Materials Engineering ICCME 23, Krakow, Poland, November 6-7,2023

As part of the 4th International Conference of Casting and Materials Engineering ICCME 23, which took place on November 6-7 in Krakow (Poland), a special **panel** was organized: **GREEN CASTING** dedicated to research carried out as part of the GREEN CASTING LIFE project (LIFE21-ENV-FI- 101074439). This project is also co-funded by the National Fund for Environmental Protection and Water Management (NFOŚiGW) under grant agreement 276/2023/Wn-06/OZ-PO-LF/D. The aim of the conference was to disseminate the latest ideas, methods and problems in engineering through presentations given by international experts. This event gathered experts and enthusiasts in the field of foundry and materials engineering from around the world. During the plenary session as part of the **GREEN CASTING panel**, 3 papers were presented devoted to research carried out as part of the **GREEN CASTING LIFE project** (LIFE21-ENV-FI-101074439):

1. **R. Dańko**, A. Kmita, J. Dańko, M. Holtzer: Key assumptions for Green Casting Life Project: Towards zero emissions in European ferrous foundries using inorganic binder systems.
2. **A. Kmita**, R. Dańko, M. Holtzer, J. Dańko, D. Drożyński, M. Skrzyński, A. Rocznik, D. Gruszka, J. Jakubski: Emission measurements of new inorganic binder systems for the production of molds and cores.
3. **R. Dańko**, J. Dańko, A. Kmita, M. Holtzer, D. Drożyński, D. Gruszka, M. Skrzyński: The influence of aqueous protective coatings on permeability of samples of the selected sand kinds – in the context of the environment protection by controlling the emission of process gases.

Book of abstracts: https://iccme.agh.edu.pl/home/iccme/BOOK_OF_ABSTRACTS.pdf

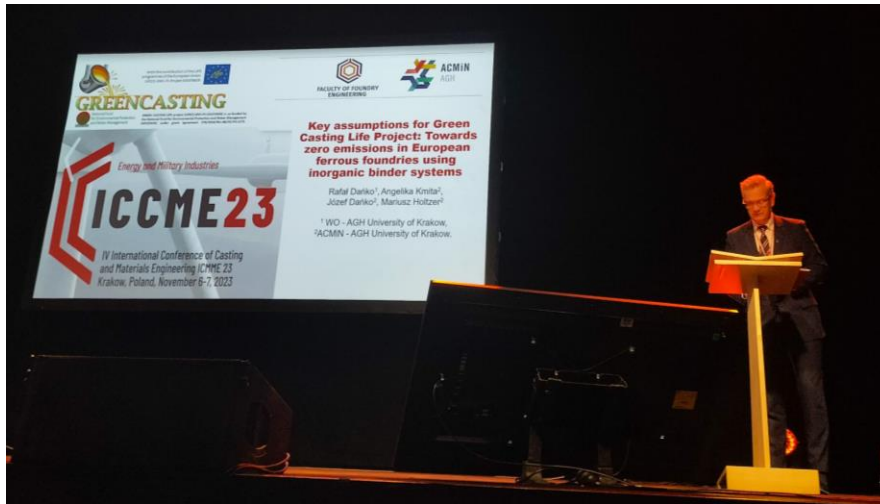


Figure 13-16. Green Casting Panel at IV International Conference of Casting and Materials Engineering ICCME 23 in Krakow, on 6-7.11.2023.

More information about IV International Conference ICCME 23 at:

<https://iccme.agh.edu.pl/about-conference>



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