



# 4th International Workshop on Spark Plasma Sintering 23 – 25 May 2018, Cagliari, Italy

**VULKANO: Novel integrated refurbishment solution as a key path towards creating eco-efficient and competitive furnaces.**

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## Highlights

*VULKANO will increase by 20% the overall energy efficiency of current heating and melting furnaces, as well as reduce up to 40% their fossil fuel consumption, by means of a novel integrated solution which comprises:*

- High-temperature phase change materials (PCMs)
- New refractories
- Optimized co-firing
- Advanced monitoring and control systems
- A holistic in-house predictive tool.

## 1. Introduction

VULKANO [1] aims to design and validate an advanced retrofitting integrated solution to increase the energy and environmental efficiency in existing preheating and melting industrial furnaces, currently fed with natural gas. This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 723803.



Figure 1. Project Logo

## 2. Methods

VULKANO -Novel integrated refurbishment solution as a key path towards creating eco-efficient and competitive furnaces– is an international collaborative project funded by the European Commission under the Horizon2020 program. The total cost of VULKANO amounts to 6.9M€ and involves 12 partners: CIRCE (ES), RINA (IT), TORRECID (E), BOSIO (SI), ASAŞ (TR), VALJI (SI), CIDAUT (ES), FIVES (FR), FRAUNHOFER (DE), IEN (PL), PCM (UK), and TECNALIA (ES).

The project aims to contribute to update the mainly old-aged European furnaces of the energy intensive industries and to create a path to follow in order to ensure a successful design in case of new furnaces.

For this reason VULKANO will design, implement and validate an advanced retrofitting integrated solution to increase the energy and environmental efficiency in existing preheating and melting industrial furnaces, currently fed with natural gas. This will be achieved through implementing combined new solutions based on high-temperature phase change materials (PCMs), new refractories, optimized co-firing, advanced monitoring and control systems and a holistic in-house predictive tool.

The integrated solution will be tested in two real demo plants for the steel and ceramic sectors, and evaluating their replicability in the aluminium sector. Besides, the project partners will analyse this replication in several other sectors.





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By means of its implementation important achievements are expected such as an increase of the furnaces energy efficiency up to 20% and a reduction of the fuel consumption up to 40%, depending on the sector.

On top of that, the holistic tool will also be able to optimize the integration of the solution with upstream/downstream perspective, following a life cycle and cost thinking. This will support plant operators and decision makers to select the most suitable retrofitting strategy for their plants, fostering overall efficiency, increase in competitiveness and circular economy and reducing the environmental impact of the product value chain.

### 3. Preliminary results

The project has satisfactorily achieved its objectives throughout this first eighteen month period, obtaining useful results:

- Operating conditions of the two demo site furnaces (steel and ceramic sector) and the requirements from the new technology solutions to be implemented at the furnace have been defined.
- Development of high temperature PCM. Laboratory tests have been carried out to compare the results obtained in simulations. Pre-implementation has been performed in a ceramic furnace.
- Compositions of the new refractory blends have been reported. For steel furnace, alumina based refractories bonded with innovative micro silica will be used, while zirconia based materials bonded by nano silica will be employed for the ceramic furnace.
- Feasibility of the natural gas substitution by different syngas sources has been analyzed and CFD simulation of syngas/natural gas mixtures with adapted co-firing burners have been performed.
- The development and implementation of the furnace monitoring and control system has been updated.
- Development and implementation of a flexible holistic in-house predictive tool prioritizing the critical parameters for each sector.
- Technical documentation to start the construction of the replica furnace has been prepared.
- An updated market analysis presentation has been carried out.

### 4. Outcome

The better use of resources and lower emissions of pollutants will guarantee a positive impact on value chains.

The expected changes of economic processes are the utilisation of renewable energy sources, the product as a service and the shift in consumption patterns.

The economic impact will be the investment in innovative solutions.

The time frame for impacts to materialize can be considered as short term (up to 2 years).

The enabling factors are the technological development and cost of technologies and the environmental awareness of consumers.

### References

[1] <http://www.vulkano-h2020.eu/>.

### Keywords

VULKANO, furnaces, refractories, co-firing.

