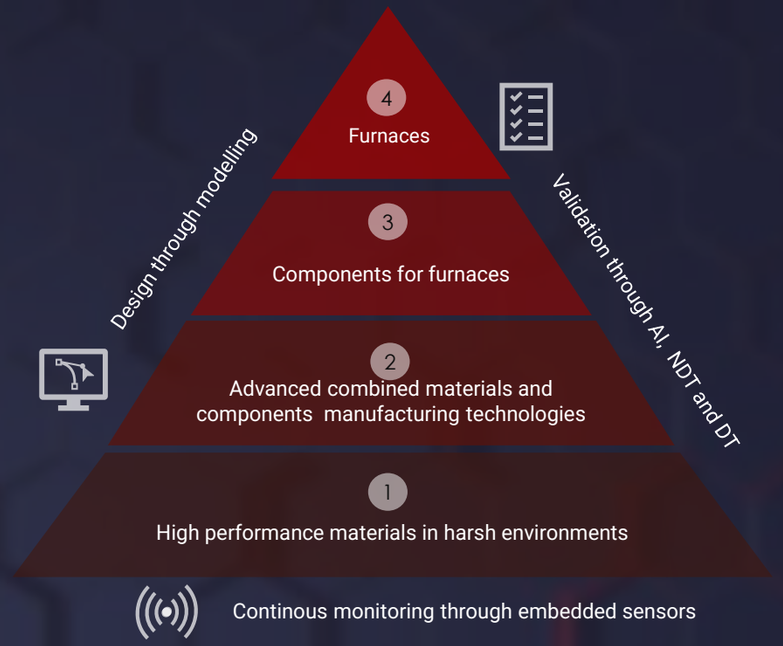

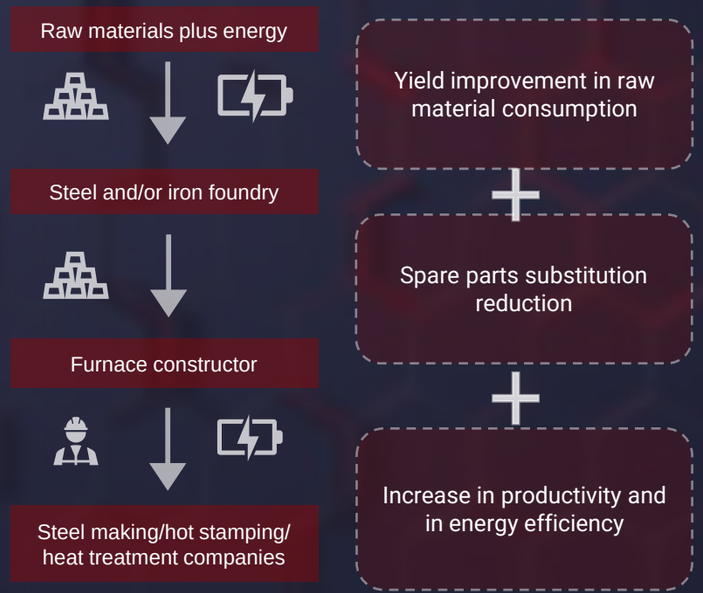

Target industry:

Process industry

Duration:

November 2020 > October 2023

Budget:

5,36 M€

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HIPERMAT

Advanced design, monitoring, development and validation of novel HIgh PERformance MATerials

PROMOTING THE SUSTAINABILITY AND EFFICIENCY OF PROCESS INDUSTRY

HIPERMAT project is focused on the integration of the advanced design tools of materials and components to increase the success rate in material selection and the durability of components.

New high thermal and corrosion resistant alloys, such as refractory stainless-steel variants and other alloys to be used for protective layer application, will be tested and validated through specific destructive and non-destructive testing.

High performance alloys will be used for end component manufacturing through cutting edge technologies such as LMD, ceramic coatings and ablation (foundry) technology.

After being validated through NDT and DT controls, components will be integrated in real hot stamping furnaces, their performance to be monitored through a developed net of embedded sensors and advance data processing tools.

AIM:
Developing more durable high temperature processing equipment

Developing longer lasting materials and components to withstand continuous high temperatures or thermal cycling, by using less resource-consuming manufacturing technologies, offers an opportunity not only to achieve important savings in energy and mineral resources in the construction and maintenance of high temperature equipment, but also improving their productivity and efficiency.

CASE STUDY: hot-stamping rolling beam furnaces

The ROLLING BEAM furnace combines horizontal and vertical movements of beams to carry steel blanks through the furnace.

The **horizontal advancing mechanism** is composed of **metallic beams** supported on rollers with rings placed along the furnace. They move over the rings in a cyclic movement forward and backwards.

Several **ceramic beams lift the blanks** while the advancing beams roll backwards to their original position and place the blanks further along on advancing beams in their downwards movement.

Tough working conditions:

- ⊗ High temperature: close to 1000ºC.
- ⊗ High loads due to the own weight of beams and the charge.
- ⊗ Corrosive environments due to the high temperature air and continuous high temperature inside the furnace.

Usual failure modes:

Thermal fatigue of beams at the entrance of the furnace, combined corrosion and creep of the inside beams and combined corrosion, creep and wear of rings.

Some rough numbers

- ⊗ Beams and rings represent 12% of the total cost of the furnace. They cause 2 maintenance stops per year.
- ⊗ On average, for a reference furnace composed of 50 metallic beams and 33 rollers (165 rings), 5 beams and 20 rings are replaced in 1 year.
- ⊗ Over the average 30-year service life of a furnace 45t of scrap are generated only due to spare parts for beams and rings. Near 70 MWh are consumed in casting new steel components.
- ⊗ For furnaces with annual outputs of over 20000 t blank, the 2 maintenance stops entail additional consumption of 0.8 Nm3 of natural gas per ton of blanks produced.

GENERAL IMPACT

Optimization of industrial processing, by optimizing component manufacturing process: reducing use of energy and raw materials and increasing the efficiency of the plant thanks to less plant shutdowns for maintenance and spare parts purposes.

Reduction of the energy and resource consumption by more efficient technologies to manufacture components and their life extension in high temperature close to 1000ºC working equipment.

Minimization of waste and energy consumption by using sustainable processing technologies. Integrating cutting-edge and more accurate modelling tools into the design of processes and materials.

Introduction of protective layers in components reducing critical elements in bulk materials and extend their service life.