HIPERMAT

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

CASE STUDY

Hot-stamping rolling beam furnace

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

Main components involved:

- Metallic beams supported on rollers with rings placed along the furnace. They move through cyclic movements.
- Ceramic beams and advancing beams that 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.

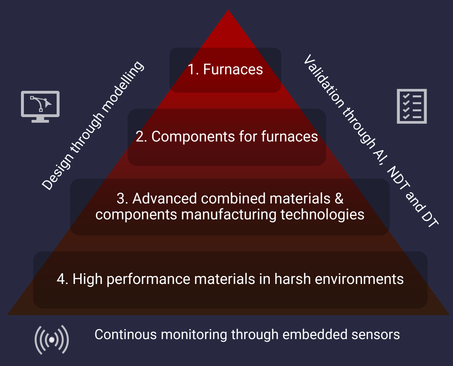
OBJECTIVES

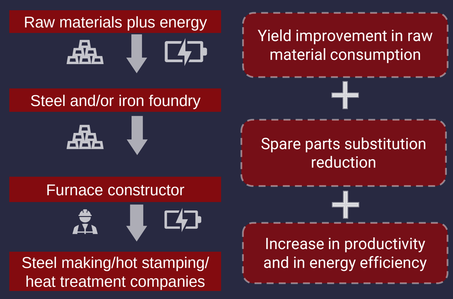
- Optimization of industrial processing by optimizing component manufacturing process: reducing the use of energy and raw materials and increasing the efficiency of the plant thanks to less shutdowns for maintenance and spare parts purposes.
- Reduction of the energy and resource consumption by more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

APPROACH

Developing longer lasting materials and components to withstand continuous high temperatures or thermal cycling as an opportunity to achieve ENERGY SAVINGS, CONSUME LESS MINERAL RESOURCES & IMPROVE PRODUCTIVITY AND EFFICIENCY.

- Integration of advanced design tools of materials & components.
- Development of new high thermal and corrosion resistant alloys to be used for protective layer application.
- Use of high-performance alloys for end component manufacturing through cutting edge technologies.
- Integration of components in real hot stamping furnaces along with ad-hoc developed monitoring sensors, combining printed electronic and thermal spray technologies, and advanced data processing tools.
- The technology developed will allow the participating SMEs to solve at least two problems: Eliminate not safe and healthy hazardous technologies currently used and improve degassing efficiency and product quality.





RESULTS

- A new family of high temperature corrosion and wear resistant refractory steels has been patented.
- Printed sensors with high accuracy have been introduced in critical areas of hot stamping furnace and are monitoring working temperatures.
- A new high yield HydroSolidification (ablation) casting process that leads to increased creep resistance has been validated.
- High wear resistance layers on real components using LMD for metallic layers and HVOF for ceramic ones are demonstrating advantageous wear resistance properties at high temperatures.
- Accurate modelling supported on experimental data are accelerating success in aforementioned developments.

Funded by the European Union

Funded by the European Union under grant agreement 958196. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.