EFFICIENT METAL PURIFICATION STRATEGY

SUCCESS STORIES

INDUSTRIAL FURNACE FOR SOLAR SILICON PURIFICATION

PRODUCTIVE SECTOR: Material

PROBLEM DESCRIPTION

Mathematical modelling and numerical simulation with the aim of improving the efficiency and productivity of industrial furnaces for metal purification, thus allowing the treatment of greater quanties of material.

CHALLENGES AND GOALS

Study of an industrial furnace for solar silicon purification. The goals is to improve its efficiency and productivity through the integral numerical simulation of the coupled physical processes (electromagnetic, thermal, hydrodynamic and structural) that take place inside it.

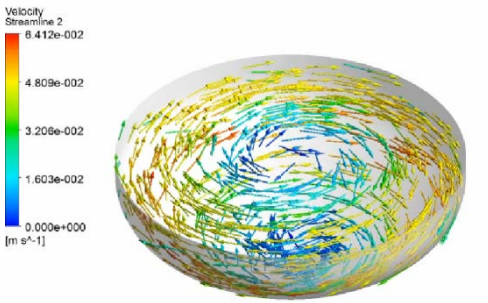
MATHEMATICAL AND COMPUTATIONAL METHODS

Mathematical Modelling of the multiphysics process: Non-linear partial differential equations: electromagnetism, heat transfer, hydrodynamics, gas kinetics, thermodynamics.

Thermo-structural analysis of the key pieces of the furnace.

Computational methods: finite elements, finite volumes, Newton's method.

Commercial Codes: Flux3D, Ansys Fluent, Ansys Mechanical.



Velocity field distribution in the metal

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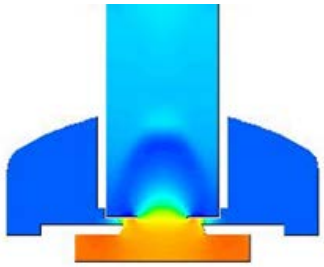
RESULTS AND BENEFITS

The company has been provided with a tool that allows it to control the behavior of the system, and to determinate the influence of the geometric and operating parameters in its performance, in order to optimize the process and avoiding trial-error tests in plant which are technically and economically very expensive.

The structural model has been added to the tool, and it allows to study with more detail parts of the machine under bigger thermal and mechanical stresses and to design alternatives without compromising the performance of the process.

Application of the model to furnaces of greater capacity, which allow to process greater quantities of material.

The numerical simulation has served the company to make a reliable estimation of the increase in power consumed by operating with larger machines without losing performance in the process.



Pressure field distribution in the pull chamber

On the basis of the results, the company was able to improve the design and operation of the solar silicon furnaces without the need to conduct costly and time consuming test.

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