

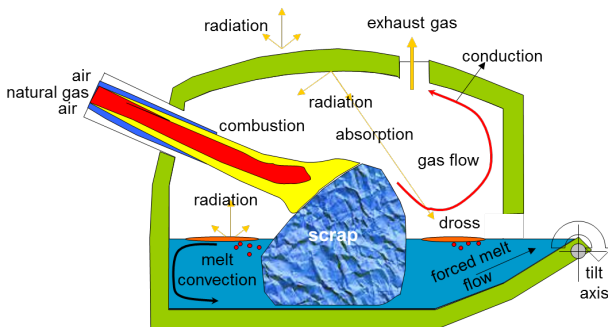
Motivation and Research Topics

Metallurgical processes face a permanent need for improved energy efficiency and reduced environmental impact. This project focus on thermodynamic reactions between scrap and melt and surface related interactions of organic contaminations during the recycling process of aluminum. Another major objective is to develop an integrated CFD model of the melting process in industrial furnaces validated with pilot and full scale experiments. This work includes the understanding of solid/gas and liquid/gas reactions as well as the fluid flow and the thermal conditions inside the furnace.



Integrated Model Approach

- Gas reactions (pyrolysis and organics decomposition)
- CFD furnace model
 - Combustion and heat transfer
 - Melt Flow
 - Reaction kinetics
 - Phase change
- Dross formation related to scrap input / solid liquid interactions
- Dross formation depending on organic residues / gas liquid interactions
- Dross formation related to salt usage



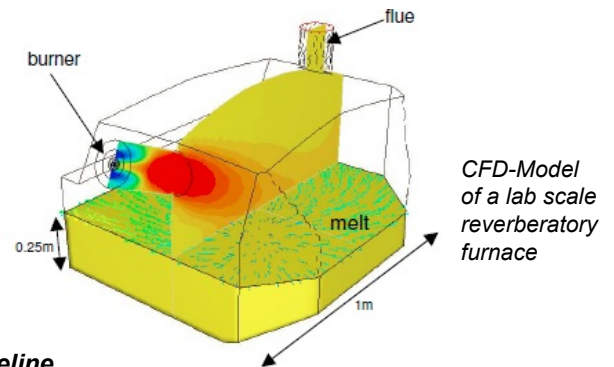
Boundary conditions of a reference furnace system

Project Objective “Virtual Furnace”

The overall project objective is an integrated furnace model enabling the development of resource efficient furnace concepts. Based on raw material specific, thermodynamic, and energetic optimization criteria the definition of new technical specifications and technology development with key suppliers is intended.

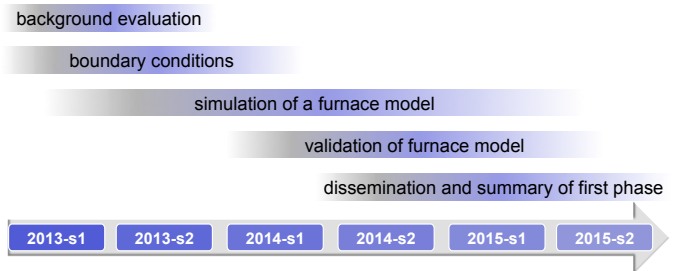
Innovative Modeling Aspects

1. The irregular distribution of metal and air in a scrap charge inside a furnace requires a specific volume averaging approach to be described in terms of a finite element or control volume method.
2. The continuous deformation of the macroscopic scrap shape by a gradual material redistribution has not been satisfactorily described in existing numerical models. Of special importance is the effect on flame evolution and radiation heat transfer in the gas void inside the furnace.



CFD-Model of a lab scale reverberatory furnace

Timeline



Research Partners

The international consortium consists of the industrial partners Aleris, Constellium, Hydro and Trimet and two University partners: Department of Process Metallurgy and Metal Recycling (IME) and Department for Industrial Furnaces and Heat Engineering (IOB) of RWTH Aachen.

