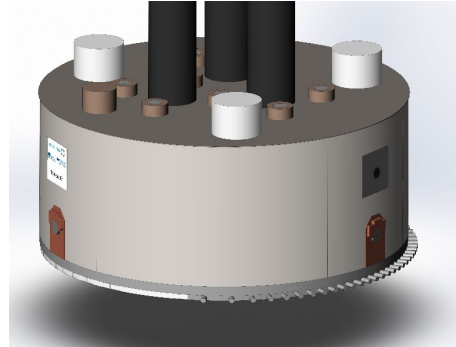


Master thesis
CFD-Modelling of a Submerged Arc Furnaces (SAF)

The reduction and smelting of ores and raw materials are at the beginning of the value chain in every process chain for material production. In terms of energy, this step is often the most intensive and therefore also the most costly for the end product.

The Submerged Arc Furnace is an electric melting and reduction unit which has been used on a large scale for ferrochrome production for decades. Due to the increased restrictions regarding the CO₂ footprint of products and the also increased costs for CO₂ emissions, a continuous energetic optimization of the process as well as the development of a general process understanding is of enormous importance for the companies concerned.



The IOB has been building up expertise in the field of arc furnace technology for decades and is also involved in flow modeling of metallurgical reactors. We see the submerged arc technology as a very relevant future topic and would like to position ourselves accordingly. In the past five years, simplified simulations of a SAF have already been carried out, which are now to be extended within the scope of this work.

Within the scope of this work, the existing CFD model of a submerged arc furnace for ferrochrome of Outokumpu Chrome Oy shall first be understood and the underlying phenomena shall be studied. Subsequently, in a first step, the reduction reactions currently taking place in firmly defined zones are to be considered in more detail, so that the specification of the reaction zones can be omitted and these can form freely according to the temperature conditions.

A visit to the ferrochromium plant of Outokumpu in Tornio (Finland) is intended to build up the process understanding at the beginning of the project work. The visit to the real plant conveys impressions that are difficult to present in the media. In addition, contacts are made which will be useful in the following modeling phase. The aim of the visit is to gain a solid basic understanding of the processes as well as technical discussions with the employees on site.

The task of the master thesis includes in detail:

- Familiarization with the CFD program Ansys Fluent as well as the existing CFD model of the ferrochrome SAF
- Research on the SAF as well as the temperature-dependent reactions of ferrochrome production
- Plant visit of the SAF for ferrochrome production of Outokumpu in Tornio (Finland)
- Implementation of a spatially unbounded approach for modeling the reactions in the SAF as a replacement for the current rigid reaction zones
- Further optimization of the SAF CFD model and parameter studies
- Written elaboration and documentation of the results

Duration: 6 month

Start: as of now

Questions and further information:

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