Apprenticeships & Theses

ArcelorMittal

TITLE: PREDICTING AND STEERING INDUSTRIAL SINTER PRODUCTIVITY BASED ON LAB-SCALE PERMEABILITY MEASUREMENTS

KEY WORDS OF ASSIGNMENT:

- ✓ Sinter plant and productivity
- ✓ Experimental permeability measurements
- ✓ Modeling physical and chemical phenomena
- ✓ Optimizing industrial plant output

SUMMER APPRENTICESHIP ☐ MASTER THESIS ☒

WORK/SCHOOL APPRENTICESHIP ☐ PROJECT ☐

CONTENT OF ASSIGNMENT:

ArcelorMittal Gent is a steel production company situated in the port of Ghent. The considerable flat steel products output is, among others, sustained by the high hot metal production rate at the two blast furnaces. These benchmark production rates are made possible through the use of high-quality iron carrier feed.

To ensure the desired chemical and mechanical properties of the blast furnace feed, the iron ore undergoes a high-temperature pretreatment in the sinter plant. A mixture of iron ore, fluxes and coke breeze as solid fuel is spread out along a moving grid conveyor belt and ignited at the top with burners. By means of ventilators and the resulting underpressure, the ignited flame front propagates through the mix from top to bottom, forming a solid *sinter cake* which is afterwards crushed into coarse particles. The rate at which the process air is translating through the sinter mix defines the sinter production rate. In other words, the permeability of the sinter mix is the main principle component for the sinter output rate.

The permeability of the sinter mix is affected by its composition, pretreating procedure, e.g., mixing and granulating, moisture, particle size distribution and segregation at the conveyor belt level. Currently, most of the parameters mentioned are managed by the operating staff in a rather pragmatic and 'based-on-experience' manner, which can lead to sub-optimal sinter production rates. At our sinter plant, we have a lab-scale permeability measuring device available. The goal of the master thesis is to draw clear correlations between the sinter mix properties, its permeability and the resulting productivity. In a second step, guidelines are to be defined which should allow the operating staff to exploit the sinter plant even more.

The master thesis will consist of literature study on sintering, combined with on-site training. Secondly, the permeability measuring device will be used to construct a dataset, supplemented with the available industrial data. During data-acquisition, there will be a high variability in the process parameters due to the fluctuations of the feed and changes in the operating conditions. This expanded dataset will be used to uncover underlying mechanisms and causation related to the sinter productivity. This elucidation is done first via extended data analysis, followed by a modeling study which links the occurring mechanisms with the experimental observations. Finally, correlations and optimization rules will be proposed which should allow to increase the sinter plant output.

OBJECTIVES:

- ➢ Get to know the iron ore sintering process, focusing on sinter productivity
- ➢ Acquire an experimental dataset (industrial data)
- ➢ Perform data-analysis to uncover the main phenomena affecting sinter productivity

Apprenticeships & Theses

- Construct a mechanistic model which can qualitatively and, if possible, quantitatively predict the sinter productivity
- Propose guidelines for the operating staff to optimize sinter productivity at ArcelorMittal Ghent

EXPECTED COMPETENCES (KEY WORDS):

- ✓ Data acquisition, data reconciliation and data analysis
- ✓ Modeling (physical and chemical phenomena)
- ✓ Good communication and presentation skills
- ✓ Open and critical mindset

NUMBER OF STUDENTS:

- 1

TARGET GROUP: BACHELOR/MASTER/ … & SPECIALIZATION(S):

- Master of science in chemical engineering
- Master of science in materials engineering

LOCATION:

- Department offices of Blast furnaces and Sinter plants (HOS) & at home or university

PROMOTORS:

- Industrial : dr. ir. Kenneth Toch (HOS)
- Academic : proposed: prof. ir. Joris W. Thybaut (Master of science in chemical engineering
  prof. ir. Kim Verbeken (Master of science in materials engineering)

FIRST CONTACT:

- Sofie De Croock: stages@arcerlormittal.com or 09/347.42.16
- To check the availability of this master thesis, please mail to stages@arcelormittal.com