SFI Metal Production

December 2017
No. 4/17

Newsletter Q4/17

In this last Newsletter for 2017, the management team in SFI Metal Production would like to take the opportunity to thank the SFI Metal Production family for the collaboration throughout 2017 and we are looking forward to continue working together towards our common goals in 2018.

Merry Christmas and a Happy New Year

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SPECIAL POINTS OF INTEREST

Ketil Rye (Alcoa) is our new leader of General Assembly.....2

Ketil Rye, the new Leader of the General Assembly

Ketil Rye (Alcoa) was elected as the new leader of the General Assembly at the GA meeting in November 2017. He continues the work after Ragnar Tronstad (Elkem), who has been leader since the centre started in April 2015. Ketil Rye's daily work is in Alcoa, as Technology Manager at Alcoa Center of Excellence.

We are looking forward to the cooperation!

Autumn meeting was organized 7-8 November 2017

The SFI Metal Production Autumn meeting was organized in the beginning of November. The meeting was divided into three session; 1) Innovation in the SFI Centre, 2) Review of research carried out in the SFI and plans for 2018 and 3) Use of Biocarbon in the metal producing industry. This year was no exception - a lot of people were attending, about 65 persons of whom 35 from industry and 30 from the academic environment.

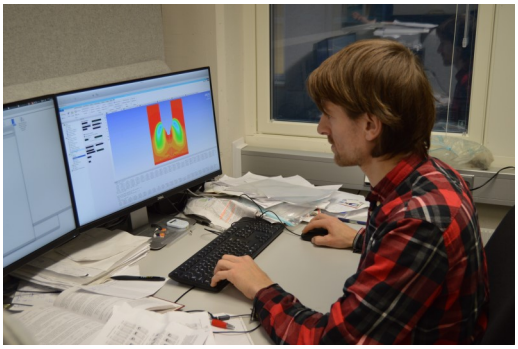
Trond Furu from Hydro was the chair of the Innovation session that started with a presentation from Executive Director Anne Kjersti Fahlvik from the Research Council of Norway with the title; "Innovation policy and practice". Norway is now facing a triple transition imperative; away from oil and gas, toward a more diversified and robust economy, with a research and innovation system that produces excellent and relevant knowledge and addressing mounting societal challenges. The SFI scheme is about the development and transition of the business sector in collaboration with the best R&D institutions.

Vice president for Innovation at NTNU, Toril Nagelhus Hernes continued with a presentation with the title "Importance of innovations". The focus for the presentation was NTNU's Strategy for Innovation and the positive impact for enterprises collaborating with NTNU. Trond Furu followed with an industrial perspective on innovation. The session concluded with an interesting and fruitful discussion.

The second session was focusing on scientific results, activities and plans for 2018 for all the five Research Domains (RD) of the SFI Metal Production. The presentations were organized in series and not in parallel so the industry could take part in all RD presentations. The topic of the last session was the use of biocarbon in metal production industry in cooperation with the competence project BioCarb+. The use of biocarbon in metal production is very relevant in order to reach the SFIs' goals regarding a clean industry and reduced emission of CO_2.

At the Tapas dinner in the afternoon of the first day of the autumn meeting, the SFI summer students presented their work carried out in their projects. Each student had made their own poster with a description of goals, methods, results and conclusion of their scientific work. This was their first successful performances as young researchers!

Sebastien Letout has finished his postdoc period in SFI Metal Production.



Sebastien Letout has for the past two years been working on modelling of the reactions taking place inside the SiMn furnace. SiMn is an important alloying element used in the production of steel, e.g. to enhance strength and toughness. A challenge with the process is that it produces about 50 % slag, which currently cannot be reused.

"We know the input in terms of raw materials and energy to melt these materials, and what we obtain after processing. It is however difficult to monitor what is going on inside the furnace, because of the very high temperatures at which the reactions take place" he says.

Sebastien has been using the power of computers and the knowledge in physics and chemistry to model and determine possible scenarios leading to the production of metal. Many complex interactions are evident in a large scale production unit, and lacking the option to observe the processes taking place inside the SiMn furnace, makes it difficult to optimise the SiMn production. His work has given a much better overview of the reaction zones in the furnace and, especially, what parameters are most influential. In the long run, a better understanding of the processes taking place inside the furnace can lead to the production of more metal and less waste, with less energy consumption and less pollution.

Since he came to Norway he has become very proficient in the Norwegian language, which he thinks has contributed a lot to getting to know his colleagues. He likes how the hierarchy plays a smaller role in professional life than in France, and that the threshold for speaking to your supervisor about an issue is lower.

Sebastien has also enjoyed the Norwegian nature during his postdoc period. He is fond of mountains and nature in general, and during his time in Norway he has had the opportunity to explore the country from many skiing, climbing and hiking trips.

Moving forward he will look for a new job, most likely in France. He says it would be nice to get a job where he could continue his research, but he is also open for other opportunities.

The SFI would like to thank Sebastien for the work he has done over the past two years and wishes him the best of luck for the future!

The Research Domains

RD1
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Attila Kovács is a new PhD student at Oxford University, co-supervised by Svenn Anton Halvorsen (TEKNOVA) and Kristian Etienne Einarsrud. The activities are shared with RD2. Atilla will work with mathematical modelling of various aspects of the alumina feeding in the Hall-Heroult process. The goal is to provide a rigorous mathematical model for the interaction between alumina particles and cryolite.

New project

Reduced CO2 emission in metal production, with a budget around 25 mill NOK has been funded by EnergiX program.

FFF and TiZir are industrial partners, SINTEF is project leader and NTNU is partner responsible for 3 PhDs. SFI gave a support letter to the application. The project is already mentioned in media; https://e24.no/energi/vitenskap-og-forskning/forskningsraadet-bruker-en-halv-milliard-paa-energiforskning/24211787

New EU-projects!!

Congratulations to the SFI scientific personell who were involved in the EU-applications and got funding.

ENSURAL, Ensuring zero waste production of Alumina in Europe with SINTEF as coordinator. ENSUREAL project's main objective is to decrease this dependence and characterise all the streams of the alumina industry in order to valorise them and make the European aluminium industry more competitive at a global scale".

RemovAl, Removing the waste streams from the primary Aluminium and other metallurgical sectors with Aluminium of Greece as coordinator. The project will be aiming at valorization of Red Mud from alumina production. Norwegian partners include Elkem Research, NTNU and SINTEF.

SecREEts, Secure European Critical Rare Earth Elements with SINTEF as coordinator. The main goal of the SecREEts project is to establish a stable and secure supply of critical rare earth elements (REEs) based on the sustainable extraction from European apatite source used in fertiliser productions. Norwegian partners include SINTEF, Yara and REEtec.

EIT RawMaterials Stakeholders Meeting

On the 28th of November, NTNU became a core partner of EIT Raw Materials, which is a European initiative to strengthen innovation and education in the raw material sector by supporting new talents and new ideas though Knowledge and Innovation Communities (KICs). NTNU belongs to the North CLC (Co Location Centre), which is based in Luleå (Sweden).

eit RawMaterials
Connecting matters

NTNU organized a partner event together with staff at the North CLC on the 29/11 to 1/12. The purpose of the event was to inform researches, representatives at the entrepreneur school, NTNU TTO and NTNUAccel about EIT Raw Materials. In addition, group discussions were organized with selected institutes to specifically discuss potential projects for the upcoming Kava call.

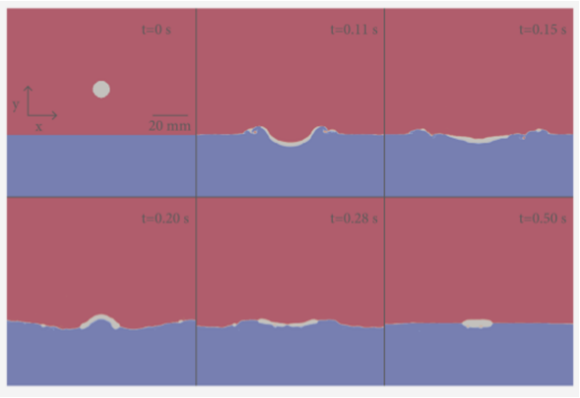
For more information about EIT Raw Materials, please visit https://eitrawmaterials.eu/ or contact the coordinator Maria Wallin (maria.wallin@ntnu.no) at NTNU.

Sindre's summer work at Alcoa

Alumina – or aluminium oxide – is the main raw material in aluminium production, typically added to the production cell at regular intervals.

Under specific conditions, yet to be fully understood, the alumina remains afloat in the cell, forming a so called raft.

During the course of the summer, master student Sindre Engzelius Gylver has collected alumina rafts at Alcoa Mosjøen – thus enabling an analysis of the raft structure and the conditions under which it is formed.



Certain conditions have during the fall been reproduced using advanced multiphase flow modelling implemented in OpenFOAM and the macroscopic structure has been analyzed using CT in collaboration with SINTEF.

The analysis and modelling work will be extended further during his master project in spring '18, including SEM and XRD, and from fall '18, as Sindre has agreed to stay with SFI Metal Production as a PhD student.

It's Christmas time again

According to the Christmas tradition Gabriella Tranell invited the SIiManTi group (MSc, PhD and postdocs) and their supervisors to her kitchen for a gingerbread architecture competition and a social gathering. Please observe the gingerbread phase diagram, but the first prize went to the chess masters:)

Reduction experiments with Comilog ore

In RD 2, melting and reduction behaviour of raw materials in SiMn production has been studied in small scale by MSc and PhD students, to investigate if we get the same results when the scale and the particle sizes are increased, SINTEF this autumn started a series of experiments with melting and reduction of 5-10 mm particles. Ingeborg Solheim has run the first reduction experiments with Comilog ore delivered by Eramet. The samples are now examined and the first results will be ready early 2018.

Picture of crucible from experiments

Cold-finger test

During week 49, Daniel Clos and Eirik Nordbø from NTNU carried out 2 short cold- finger tests at Hydro Sunndalsøra for the scaling project in RD4. Scale samples were collected and will be analysed using ICP, SEM and EPMA. Simultaneous off-gas samples were collected by Hydro and will be correlated with the collected scale sample compositions. A second measurement campaign will be run in the beginning (Jan-Feb) of 2018.

NTNU/ SFI Metal Production owns now a Heavy Volatile Hydrocarbons analyzer type "airmo VOC C6C12"

The instrument was initially designed for air quality monitoring but is capable of analyzing up to 32 compounds and among other VOC compounds such as benzene, toluene, ethylbenzene, m&p-xylene and o-xylene) form C6 to C12. A feasibility test was conducted at the gas cleaning facilities ALCOA Mosjøen 07.12.2017.

The analysis of flue gases of anode baking furnaces sampled from the top of the bag-filter house showed promising results. The gas chromatograph is equipped with permeation tubes for calibration, a pre-concentrating trap and a robust flame ionization detector (FID) which allows for monitoring of for example benzene and naphthalene in a close to online manner, with a sensibility below 100 ppt up to ppm levels.

Further measurement campaigns are planned in the end of January 2018.

Upcoming events

2018

February 1-2	**Dust/Fugitive Emissions, Seminar** Trondheim, Norway
1.quarter	**Recycling Seminar** Trondheim, Norway
April 18-19	**SFI Metal Production Spring Meeting** Trondheim, Norway
November 6-7	**SFI Metal Production Autumn Meeting** Trondheim, Norway
November	**General Assembly Meeting** Trondheim, **Norway**

SFI Metal Production

Metal Production is an interdisciplinary Centre for Research-based Innovation (SFI). During the next decades, the Norwegian metal industry will need to achieve even higher-quality output with more efficient use of resources and energy.

The main goal of the Metal Production is to enable industrial innovation and give the industry long term access to world class fundamental competence and candidates. This will enable the industry to maintain its position at the forefront of sustainable innovation.

metal production

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Nancy Holt, Hydro

Ketil Rye, Alcoa

Leif Hunsbedt, Eramet

Ragnar Tronstad, Elkem

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Svenn Anton Halvorsen, Teknova

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Cold-finger test

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