

SFI METAL PRODUCTION

Newsletter No 2/19

The summer holidays are soon over. Last week the new students gathered for the enrolment ceremony at the NTNU which indicate that the autumn has started and that the university area is back to normal again with happy and cheerful students. However, our laboratories and offices have been kept busy during the summer holidays due to our talented young summer students working for SFI Metal Production and associated projects. In this edition of the Newsletter, some of them have been interviewed and are sharing exciting projects results.

As always, the Autumn is a busy time. In the Comings Events on the last page of this Newsletter, you will find events like the Control Tapping Day, Reduced CO₂ Day, INTPART CaNAI meeting and several courses. The SFI Autumn Meeting will be in Trondheim, November 5-6th. This Autumn we will also come on site visits to the industry partners of SFI Metal Production.

The Midway Evaluation process is finished. The SFI Metal Production will continue on the same track also for the remaining years. Thank you very much to the SFI Metal Production Family who have done an outstanding work these first four years. We are looking forward continuing the good work and create results with a potential for innovations for our industry partners!

See you all this Autumn, either at the SFI meeting in November, courses, meetings, site visits or just at a pleasant coffee time.

*Aud N. Wærnes
Center Director*

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Summer in Grøndalen, Flora Kommune. Photo M. Lenes



SUMMER STUDENTS

SFI and Associated Projects

Despite it being summer, our laboratories and offices have been kept busy due to the work of our talented young summer students. Here are some of them who have shared the exciting projects they are working on.

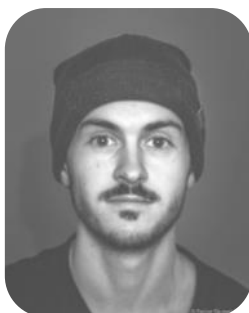


Andreas Voll Bugten

Andreas is beginning his fourth year of material science here at NTNU in autumn. This summer he is working for Kai Erik Ekstrøm on the RemovAL project "which is about extracting iron/FeSi from red mud". "My role is to conduct the experiments, so I prepare the experiment and run them in the furnace. Then I take samples and prepare them for the analysis which Kai Erik will do with EP-MA. "The most interesting part is the high temperatures, it sure does get quite hot."

Maria Renkel

Maria is a Materials Chemistry student at NTNU, working for Gabriella Tranell and Mertol Gokelma on the BEST project this summer: "We want to study oxide and carbide interaction, and aluminium melts by blowing through inert gas". Her role in the project is "experimental design, so setting the experiment up and working with everything from making the filter to analyzing the data afterwards by cutting it up and studying it in SEM". "I enjoy actually studying the interactions, but If we see anything, that's the question".



Petter Sjusen

Petter is studying mechanical engineering at the Gjøvik branch of NTNU and he is to start at his second year of his bachelors this fall.

This summer Petter has been working for the SFI on the production of a educational/promotional video about the work and research the SFI (and Norway) is doing to make Norway one of the most carbon neutral production-centrals for metals in the whole world. "I have had help from researchers at NTNU, Finnfjord AS, Bellona and SINTEF to put together a script, and for interviews."

More detailed, Petter's work this summer was to assemble the whole video, which means doing most of the filming, editing, directing and interviewing. "I have been in Oslo and interviewed people at the environmental foundation BELLONA and I have been in Tromsø and Finnfjord to hear about their alga-CO₂ reduction-project but the most interesting part this summer has been to hear about all the good work the metal production industry of Norway is doing to reduce the environment impact"



Sigvart Hansen Eggen

Sigvart just finished his master's degree in material science at NTNU, where he specialized in resources, energy and environment. "This summer I am working on publishing my thesis at TMS. For my thesis I looked at the recyclability of aluminium that ends up in the municipal waste. Typically, municipal waste will be about 1-2% aluminium, which you can try to recycle, and we did a lot of experiments on just that. So essentially that is what I'm going to publish". "I collaborated with Sintef, Hydro, the SFI and also a garbage company called IVAR Iks, located in Stavanger." As a student he designed and executed the experiments which he based his thesis on: "So I guess I'm just continuing that work this summer". On what he finds most interesting about the summer job he says "We are hoping to do some more experiments on a different sample material, and if we could do that it would be very interesting to see if the results are similar to the experiments we did this spring."



Idun Brekken

Idun is a nanotechnology student here at NTNU who has just finished her third year. This summer she is working on the AIPakka project; "My job specifically, is to do a literature study on China, the US, and the European union to see what they are doing there and if we maybe can learn something from them here in Norway". For her, the most interesting thing about the summer job is "hard to choose", but "it's been interesting to see how they do it in China because it is a very different culture and they have a very different way of doing things, so I found out about a lot of things I didn't know before."

Sofie Verschraegen

Sofie is a fourth-year student of material science at Gamt university in Belgium, who has also been an exchange student here at NTNU during the spring semester. This summer she is working for Anne Kvithyld on the AIPakka project. "My focus is multilayer packaging, a combination of polymers and aluminum which is really hard to recycle as they are such different materials and have such close contact." "I really like the fact that I can work in Norway with aluminium because it is really big in Norway, and I feel privileged that I can contribute to recycling - which is the topic of our era."





Gjermund Lie Solbakk

Gjermund Lie Solbakk is a material science student at NTNU and has just finished his third year. He is working on several projects this summer, but the one he has worked the most on is for Gabriella Tranell and Erlend Lunnan Bjørnstad (SFI Metal Production): "We're doing kinetic experiments on the transfer of minor elements from silicon to silicon oxide and calcium oxide slag. My role is doing all the experiments, so sitting in the lab with a furnace all day." The most interesting thing about the summer job for Gjermund is "*actually* testing out the theory that we learn, in practice. Then seeing how everything goes wrong, and then dealing with it."

Endre Wangsholm

Endre Wangsholm is a soon to be fourth year material science student at NTNU. He is also working on several projects this summer, mainly for two PhD students. "The two PhD students I'm working for are Erlend Lunnan Bjørnstad and Håkon Olsen and SFI Metal Production. For Håkon I'm working with the IF75 furnace, which has high temperatures and uses ferromanganese. Dust will come from that experiment, and is collected in a filter box. I'm measuring how much dust is formed during the experiment. I also do another experiment for Håkon, testing sensors. I use a smoke machine to send smoke through a tube and test the sensor response to changing temperature, humidity and dust amount".



Ilayda Elif Öner

Ilayda Elif Öner is an Erasmus student from Turkey who studies metallurgical and material science and engineering at Istanbul Technical University. She is in her fourth year of studies at her home university. This summer, she is working for Gabriella Tranell and Mertol Gokelma: "Our project is about recycling aluminium either from incineration bottom-ash or nespresso capsules - the used coffee capsules. We melt down the samples in a saltflux and this is how we get rid of oxide layers and refine the aluminium". Ilayda does the experiments, works in the laboratories and examines the samples afterwards. On her experiences and exchange internship she says, "I really enjoy being here, and being an international student together with Norwegian people. I enjoy practicing at another university, and experiencing how things work over here is really interesting to me."





Coming:

PhD Dissertation

21. August - Trondheim

This week, PhD candidate Hamideh Kaffash will defend her Doctoral Thesis "Dissolution kinetics of carbon materials in FeMn". The dissertation will be held August 21, 2019 and Professor Merete Tangstad has been the candidate's supervisor.

Public trial lecture is on "Production of Mn sinter in the Mn-process"

Scaling/fouling Workshop

June 5, Trondheim Norway

On June 5th, a workshop on scaling/fouling in the metal industry was organized. Both the industry and academia contributed with presentations, covering a broad variety of topics. The presentations provided insight on the fundamental understanding of scale formation mechanisms, industrial experiences with scaling and fouling and recent PhD results. It is clear that this topic is relevant for all branches of the metal industry. The workshop was concluded with a plenary discussion on the way forward within this field in the SFI and other projects.

Thank you to the participants for interesting presentations and fruitful discussions!





The Dross and Packaging Recycling Workshop

- A success!

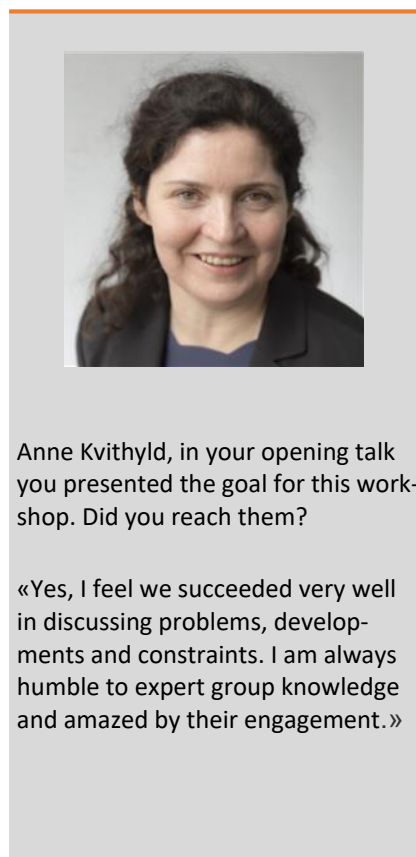
May 15-16, 2019, Trondheim Norway

The International Dross and Packaging Recycling Workshop was arranged May 15-16 in Trondheim as a part of SFI Metal Production's activities. When announced, this workshop showed to be pretty popular and we needed to minimise the number of participants to around 40 in order to get a productive workshop. Except from SINTEF and NTNU twelve companies: Hydro, Alcoa, Novelis, Linde Gas, Norsk Metallgjenvinning, Gränges, Kavli, Metallco, Infinitum, Real Alloy, Constellium and Trimet Aluminum and two interest organisations: European Aluminium and Aluminium Association participated in this workshop.

The goal for these two days was to review recent problems and developments in dross and aluminium packaging recycling to better our understanding of where more research or technical effort is most needed. The enthusiastic participants worked hard during these two days and carried out four workshop sessions together. The first on Recyclable aluminium including collection, the second on Remelting Technologies and the third on Dross, Saltcake and the fourth and last on Quality and use of recycled Aluminium & Dross.

The program shows a push against the future perspective in all the presentations and workshop sessions and the evaluation done by participants showed that this will be a repeatable event.

The organiser at SINTEF Industry, Anne Kvithyld and Berit Fossum, did tremendous work with this workshop and got a lot of positive feedback in the finishing questionnaire. Thanks to the participants and the organisers for making this workshop a success!



Anne Kvithyld, in your opening talk you presented the goal for this workshop. Did you reach them?

«Yes, I feel we succeeded very well in discussing problems, developments and constraints. I am always humble to expert group knowledge and amazed by their engagement.»





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SFI management visit Karmøy Technology Pilot

Aluminium activities coordination meeting and visit to Karmøy Technology Pilot, 24 - 25 June

The SFI leader group represented by Aud Wærnes, Arne Petter Ratvik, Anne Kvithyld, Gabriella Tranell and Leiv Kolbeinsen met with representatives for the aluminium industry, Nancy J. Holt, and Trond Furu (Hydro), Ketil Rye and Harry Salvesen (Alcoa) and Anders Sørhuus (GE) to discuss results obtained, as well as activities and priorities for the aluminium industry during the second half of SFI Metal Production. The visit was completed by an extensive visit to the electrolysis pilot plant, as well as the foundry.

Thank you to Nancy Jorunn Holt for organizing the visit and the generous reception and tour by Hydro Karmøy.



Presentation of MSc Students



From the left: Katrine Sellevold, Sigurd Øvrelid, Eirik Nøst Nedkvitne, Eirik André Nordbø, Tobias Mohn Werner, Sigvart Hansen Eggen, Azam Rasouli, Ine Mariell Fagerbakk Haugli. Not pictured: Malin Salvesen

7. June - Trondheim

On June 7th this year's master students of the REM-group (Resources, Energy & Environment) had the end-of-MSc degree celebration day. This time, it was a joint celebration with other graduating students at the department and a presentation session for the REM students.

Throughout the day, all the students showcased their theses, as well as some of their most important results. The students who presented their work were the one in the picture above.

Professor Merete Tangstad closed the program and the day came to an end with mingling at the SFI Metal Production's area.

SFI Metal Production, NTNU and SINTEF would like to thank all students for their efforts in the past year and wish them the best of luck in their future work!



Pictured: Sigurd Øvrelid



Photos: Merete Tangstad



The Jean-Sébastien Thomas Prize 2019 to Halvard Tveit and Leiv Kolbeinsen!

In May 2019, the Scientific and Organization Committees at SAM 13 in Pisa, Italy, awarded The Jean-Sébastien Thomas Prize of 2019 to Halvard Tveit (Elkem) and Leiv Kolbeinsen (NTNU) for the paper entitled **“The (love and hate) role of entropy in process metallurgy”**.

Congratulations to Halvard and Leiv!

The Jean-Sébastien Thomas Prize (JSTP) has been established in tribute to the former Head of the Global R&D Sustainability department who died in December 2014. Jean-Sébastien was an eminent member of the Sustainable Development community, recognized both within Arcelor-Mittal and among his peers. The Jean-Sébastien Thomas Prize rewards the most innovative paper – relating to methodology, experience or results – presented at the annual Society & Materials (SAM) conference.



Photo: Lauriane Bieber

EiT Raw Material — Funding for three new projects

Three of our applications to EIT Raw Materials KAVA call were selected for funding!

1. HydroMetEC (Education project) with Jafar Safarian (NTNU) as coordinator.
2. RecycleMyPhone (Education project) with Ragnhild E. Aune and NTNU as partner.
3. ReLieVe (Up-scaling/Research project) with Ragnhild E. Aune and NTNU as partner.

As Associated Professor Jafar Safarian says "The HydroMetEC will educate professional metallurgists, engineers and students in primary and secondary raw materials and their treatments through hydrometallurgical processes to extract valuable metals and to promote circular economy in raw materials sectors. State-of-the art and professional innovative training courses and international seminars will be organised during 2020-2023.



Coming events

August 21, 2019, Hamideh Kaffash will defend her Doctoral Thesis «Dissolution kinetics of carbon materials in FeMn», Trial lecture: «Production and properties of Mn sinter in the Mn process»
H1, Main Building, NTNU Gløshaugen

October 1, 2019, Controlled Tapping day
Trondheim, Norway

October 2, 2019, Reduced CO₂ day
Trondheim, Norway

October 7-10, 2019, INTPART CaNAI meeting and 2nd Summer School (in cooperation with REGAL student day <https://www.regal-aluminium.ca/en/jer-en/jer-2019/>)
Université Laval, Quebec City

October 14-18, 2019, SFI-Metal Procution and FME-SUSOLTECH Centers organize a full week event on theories and processes for the prodution, refining and recycling of silicon.
- Course module 1: Mg production process (14-15 oct.)
- Course module 2: Silicon refining and SoG- Si feedstock procution (16-17 oct.)
- Solar Industry forum: Material loss and recycling/PV silicon procution and use (Friday 18 oct.)
Trondheim, Norway

November 5-6, 2019, SFI Metal Production Autumn Meeting
Trondheim, Norway

November 19-20, 2019, EiT Raw Material, Partner Days
Trondheim, Norway



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Ketil Rye, Alcoa

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Marit Dolmen, Elkem

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