SFI METAL PRODUCTION

Newsletter No 1/20

In this issue

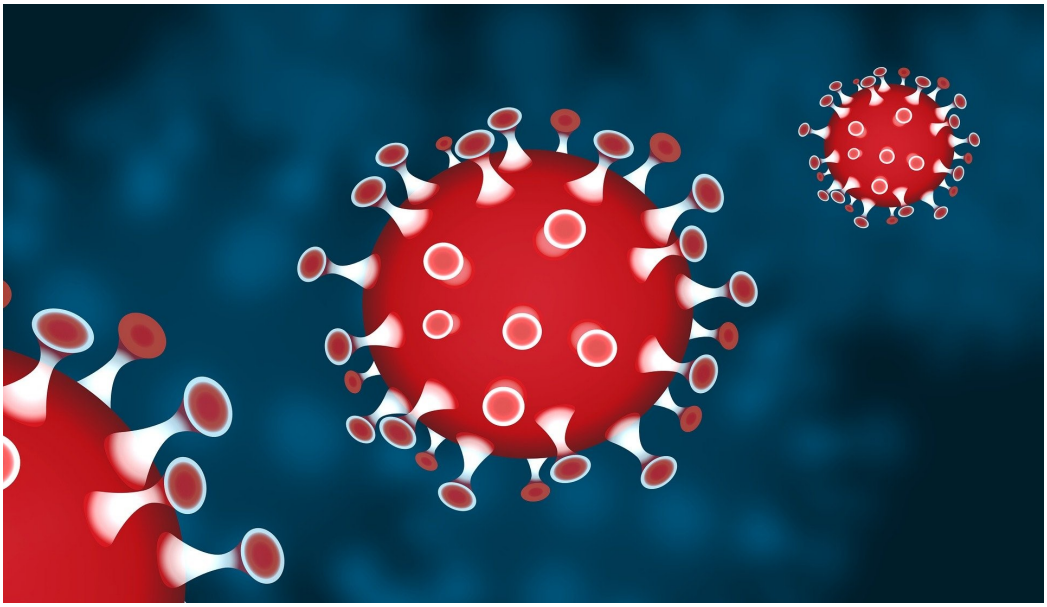
From March 2020 the coronavirus situation has affected people and activities at SFI Metal Production. In this newsletter you can read about how we rapidly adapted to the new situation and found new ways to work and communicate.

Despite the extraordinary situation we have managed to receive new EU funding, we have organized (online) conferences and two PhD candidates have successfully defended their thesis. Read more about past and coming events in this newsletter!

Aud N. Wærnes, Centre Director

2020 - a different year!

From March 2020 the extraordinary coronavirus situation has highly affected people and activities at SFI Metal Production. We all were forced to rapidly adapt to the new situation and find new ways to communicate.



March 12th it was decided that neither students nor staff should stay at NTNU campus. NTNU declared that all physical, scheduled lessons and practical training were cancelled, and the main rule should be that all employees work from home. All trips were cancelled for the next months for all research partners as well as for partners from the industry.

Instructions from the government, SINTEF and NTNU has been followed strictly. Soon Teams, Skype and Zoom replaced all physical meetings and the management and the various groups managed to keep in touch virtually.

Some of the scheduled laboratory activity had to be cancelled, and this affected both students and researchers. Still we managed to keep up the most important experiments and most of the student projects have been completed during spring/summer. From May NTNU has been cautiously reopening, allowing students and employees back to campus. SINTEF has managed to keep the scientific activities running almost as normal in this periode.

Several meetings, seminar and conferences were planned for spring and summer 2020. They have all been cancelled, postponed or carried out as online events. Although we are sorry for all the cancellations we see positive effects of the new «online communication». Making the spring meeting a webinar enabled a very good dissemination of results in spite of the present travel restrictions. In many respects the webinar format enabled a better result dissemination than the traditional face-to-face meetings, as we could now invite participants from a broader audience. Another upside was that less time was spent in travel and the ime consumed was focused on the hours the webinar was open.

On the next pages you can read more about online meetings (Silicon Conference in June and the SFI Spring meeting in April) online PhD defences and other activity carried out in 2020.

EU funding to SFI Metal Production—several new projects

In the beginning of 2020 Professors Merete Tangstad and Gabriella Tranell from SFI Metal Production received funding for **INTPART projects** from the Research Council of Norway. INTPART is a programme for International Partnerships for Excellent Education, Research and Innovation. The objective of the INTPART programme is to develop world-class research and education in Norway through long-term international cooperation with priority partner countries. The purpose is lay a foundation that enables such research groups to develop longterm relations with strong academic groups in the priority countries.

Professor Merete Tangstad's receives 5,6 mill for the project "Thanos"

Professor Merete Tangstad is the PI for the project "Thermodynamic from nanoscale to operational scale" with the shortname "Thanos". The cooperating partners in the project are NTNU and SINTEF in Norway, Mintek and North West University in South Africa, University of Science and Technology Beijing in China and the University of Tokyo in Japan. The projects will receive a total funding of 5,6 mill NOK over three years.

From Merete Tangstad's visit to South Africa with project partners from North West University.

Professor Gabriella Tranell's receives 5,7 mill for the project "Extreme"

Development and production of new alloys and coatings that can withstand harsh conditions found in aerospace, metallurgical and biomedical applications are the focus of this project. Materials and coatings that need to withstand extreme corrosive, thermal and abrasive environments are in rapidly growing demand. Since material degeneration processes are often very similar, research into their production, properties and use is naturally interlinked. The project is a collaboration between leading institutions from Norway (NTNU/SINTEF), the United States (U. Connecticut, U. Pittsburgh and U. Virginia) and Germany (RWTH Aachen).

The project will develop lasting networks in education and research through international summer schools, a joint international symposium together with industry partners in the different countries, exchange of candidates and faculty staff and a joint PhD course. The project will receive a total funding of 5,7 mill NOK over three years.

New EIT Raw Materials project - More sustainable production of Silicon from quartz

The project SisAl Slag Valorisation coordinated by prof. Gabriella Tranell receives funding from the EU body EIT Raw Materials. Prof. Ann Mari Svensson and Assoc. Prof. Jafar Safarian will also be active in the project. The project is an acceleration action within the thematic area: Increased resources efficiency in mineral and metallurgical process. The duration of the project is three years and the total budget is about 4.8 M Euro.

The project aims to produce Silicon (Si) from quartz (SiO_2) in a more sustainable manner by replacing carbon with secondary aluminium sources (i.e. scrap and dross) as reductant and in parallel making an intermediate slag, which is a perfect precursor for High Purity Alumina (HPA) processing, see figure below. Silicon and HPA are vital raw materials for the transition to the low carbon society; Si as a dominant photovoltaic (PV) material for solar energy applications and as an important ingredient in light-weight applications (automotive and others), while HPA is a key material in Light Emitting Diodes (LEDs) and increasingly in Lithium Ion Batteries (LIBs).

Today, both Si and HPA are produced non-sustainably; for each tonne of Si produced high amounts of CO_2 and other harmful pollutants are realised. Similarly, HPA is today made from ultrapure primary aluminium, having a large CO_2 footprint. In the SisAl process these two products will be produced with a much lower environmental impact. In order to lower the already superior low CO_2 footprint of the SisAl process, an integrated CO_2 looping will also be introduced in the SisAl slag valorisation project. Si and HPA produced through these processes will be validated for market introduction towards the end of the project. The project consortium covers the value chain from raw materials provider to product user, with partners from SME´s, companies, institutes and universities:

Congratulations!

Two PhD candidates from SFI associated projects have defended their thesis during first part of 2020: Dr Karin Fjeldstad Jusnes and Dr Fabian Imanasa Azof. SFI Metal Production thanks Fabian and Karin for doing important and high quality research during your PhD periode.

PhD Dissertation – Karin Jusnes

June 19th - Trondheim

Congratulations to Dr Karin Fjeldstad Jusnes who successfully defended her thesis June 19th. Karin did an excellent and comprehensive presentation of the trial lecture: "Sustainable Low-Carbon Footprint Production of Si and FeSi" followed by the presentation of her PhD thesis "Phase transformations and thermal degradation in industrial quartz".

The doctoral work has been carried out at the Department of Materials Science and Engineering, where Professor Merete Tangstad has been the candidate's supervisor. Senior Research Scientist Eli Ringdalen, SINTEF Industry has been the candidate's co-supervisor.

Jusnes did her PhD work in the associated SFI project, the IPN project of Elkem called High Temp Quartz.

She will from the fall 2020 start to work at Finnfjord, and will hopeful be seen in the future SFI meetings.

PhD Dissertation – Fabian Azof

May 8th - Trondheim

Congratulation to Dr Fabian Imanasa Azof who successfully defended his thesis May 8th.

Fabian did an excellent presentation of the trial lecture "Alumina quality, performance and applications: Dependence on ore quality and production process" followed by the presentation of his PhD thesis "Pyrometallurgical and Hydrometallurgical Treatment of Calcium Aluminate-containing Slags for Alumina Recovery".

Associate Professor Jafar Safarian has been the candidate's supervisor. Professor Leiv Kolbeinsen and Adjunct Professor Yongxiang Yang at Department of Materials Science and Engineering have been the candidate's co-supervisors.

Webinar series from SFI Metal Production

- presentations on the topics Silicon, Manganese and Aluminium.

Welcome to SFI Metal Production webinar series 2020! Every other week we invite you to 45-minute online presentations on the topics Silicon, Manganese and Aluminium.

Time	Topic	Contact persons
Fridays at 10:00 -10:45	14 Si Silicon	Gabriella Tranell og Merete Tangstad, NTNU gabriella.tranell@ntnu.no
Fridays at 11:00-11:45	25 Mn Manganese	Gabriella Tranell og Merete Tangstad, NTNU gabriella.tranell@ntnu.no
Thursdays at 15:00-15:45	13 Al Aluminium	Anne Kvithyld, SINTEF anne.kvithyld@sintef.no

Program autumn 2020

Date	Time	Title	Presenter	Topic
28 Aug	*10.00-10.45*	*Slag i Si/FeSi furnaces*	Marit Buhaug Folstad, NTNU	Silicon
10 Sept	*15.00-15.45*	*Effect of Steam on Aluminium Packaging Multilayers*	Martin Syvertsen, SINTEF	Aluminium
11 Sept	*10.00-10.45*	*Si/FeSi Furnace excavations*	Michal Ksiazek, SINTEF	Silicon
11 Sept	*11.00-11.45*	*Emissions in Mn-alloy production*	Ida Kero, SINTEF	Manganese
24 Sept	*15.00-15.45*	*Modelling of aluminium stocks and flows*	Romain Guillaume Billy, NTNU	Aluminium
25 Sept	*10.00-10.45*	*SiC in Si/FeSi furnaces*	Sethulakshmy Jayakumari, NTNU	Silicon
25 Sept	*11.00-11.45*	*Electrical conductivity in carbon materials and charge mixtures*	Gerrit Surup, NTNU	Manganese

Webinar program October—December 2020

Date	Time	Title	Presenter	Topic
8 Oct	*15.00-15.45*	*Aluminum recovery from white dross by a mechanically activated phase separation and remelting process*	Artur Kudyba, NTNU	Aluminium
9 Oct	*10.00-10.45*	*Effect of melting properties quartz on Si and FeSi production*	Eli Ringdalen, SINTEF	Silicon
9 Oct	*11.00-11.45*	*Prereduction of Comilog and Assmang ore*	Trine Asklund Larsen, NTNU/ SINTEF	Manganese
22 Oct	*15.00-15.45*	*Measuring light hydrocarbons at Alcoa Mosjøen*	Ole Kjos, SINTEF	Aluminium
23 Oct	*10.00-10.45*	*The interaction between Ca and Al in Si-refining*	Erlend L. Bjørnstad, NTNU	Silicon
23 Oct	*11.00-11.45*	*Slag/metal separation – interfacial tension*	Sergey Bublik, NTNU	Manganese
5 Nov	*15.00-15.45*	*Alumina Dissolution*	Sindre Engzelius Gylver, NTNU	Aluminium
6 Nov	*10.00-10.45*	*Two-zone furnace*	Michal Ksiazek, SINTEF	Silicon
6 Nov	*11.00-11.45*	*Carbide production in manganese furnaces*	Vincent Canaguier, SINTEF	Manganese
19 Nov	*15.00-15.45*	*Hard grey scale formation in aluminium production*	Daniel Clos, NTNU	Aluminium
20 Nov	*10.00-10.45*	*Use of hydrogen in Si production*	Trygve S. Aarnæs, NTNU	Silicon
20 Nov	*11.00-11.45*	*Title tbd*	Varun Loomba, NTNU	Si/Mn
3 Dec	*15.00-15.45*	*Microalloying elements to prevent oxidation*	Nicholas Smith-Hanssen, SINTEF	Aluminium
4 Dec	*10.00-10.45*	*Coupling modelling tools in modelling of metallurgical processes*	Halvor Dalaker, SINTEF	Si/Mn
4 Dec	*11.00-11.45*	*Properties of Biocarbon*	Nicholas Smith-Hanssen, SINTEF	Si/Mn

Silicon Conference - 100 online participants

The Silicon for Chemical and Solar Industry conference was originally going to be arranged in Trondheim from15th to 18th of June 2020.

Due to the Covid-19 situation the confernce was changed to an integrated webinar with proceedings and online talks: A 3 hours plenary webinar, taped presentation of the rest of the papers, as well as the standard proceedings.

The aim of Silicon for the Chemical and Solar Industry conference is to discuss new development in Silicon Process Technology, Silicon Quality Assessment and Performance in the Subsequent Chemical Reactions including resource, energy and environmental issues.

The different processes from quartz to metallurgical and solar grade silicon, silicones or electronic silicon are strongly linked, and a sustainable process is dependent on a thorough understanding of the total process. The development of production of solar grade silicon directly by metallurgical routes is also included.

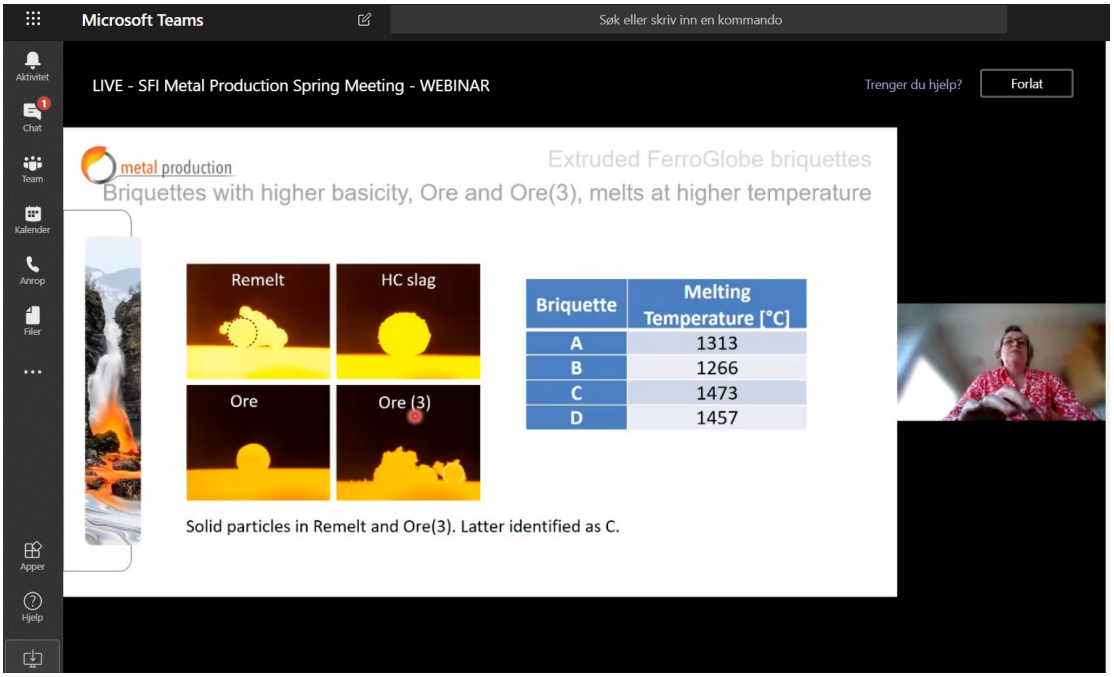
Worldwide almost 100 participants from silicon industry, users and academia registered for the conference.

SFI Spring meeting—a successful online webinar

April 29th SFI Metal Production organized the yearly Spring Meeting. Due to the extraordinary coronavirus situation the traditional two-day spring meeting were replaced by an all-day online webinar. A positive effect was that the online solution enabled more participants from the industry and research institutions outside Trondheim to join the meeting.

Use of sustainable biomass in Norway

Gisle L. Johansen from Borregaard opened the meeting with an interesting talk on Availability of biomass for reductant production in Norway. Johansen is the Head of the Expert team in Process21- "Biobased Process Industry" where the goal is to increase the value creation and reduce GHG emissions in the Norwegian process industry based on the use of sustainable biomass. For the SFI partners, the Silicon and Ferrosilicon producers are using some biocarbon in their production, appr. 530 000 fm3 in 2019. In Norway, 11 mill fm3 of wood was logged in 2019 of which 4 mill fm3 is exported to Finland and Sweden. The need biomass (bioethanol and biocarbon) in the process industry is estimated to 8 mill fm3. So, the competition for biomass in Norway will be high!



From RD leader Merete Tangstad's presentation on Primary Metal Production.

Presentations of major achievements and results in SFI Metal Production

The five research domains presented major achievements and results. The Centre activities cover the value chain from raw materials, primary metal production, recycling and emissions.

The presentations covered examples from the value chain from RD1) modelling - Pragmatic hybrid modelling and modelling of the electrical conditions in a SAF -furnaces from the ElMet projects, RD2) raw materials - electrical conductivity in charge materials and briquettes. RD3) Better utilisation of materials in the production of

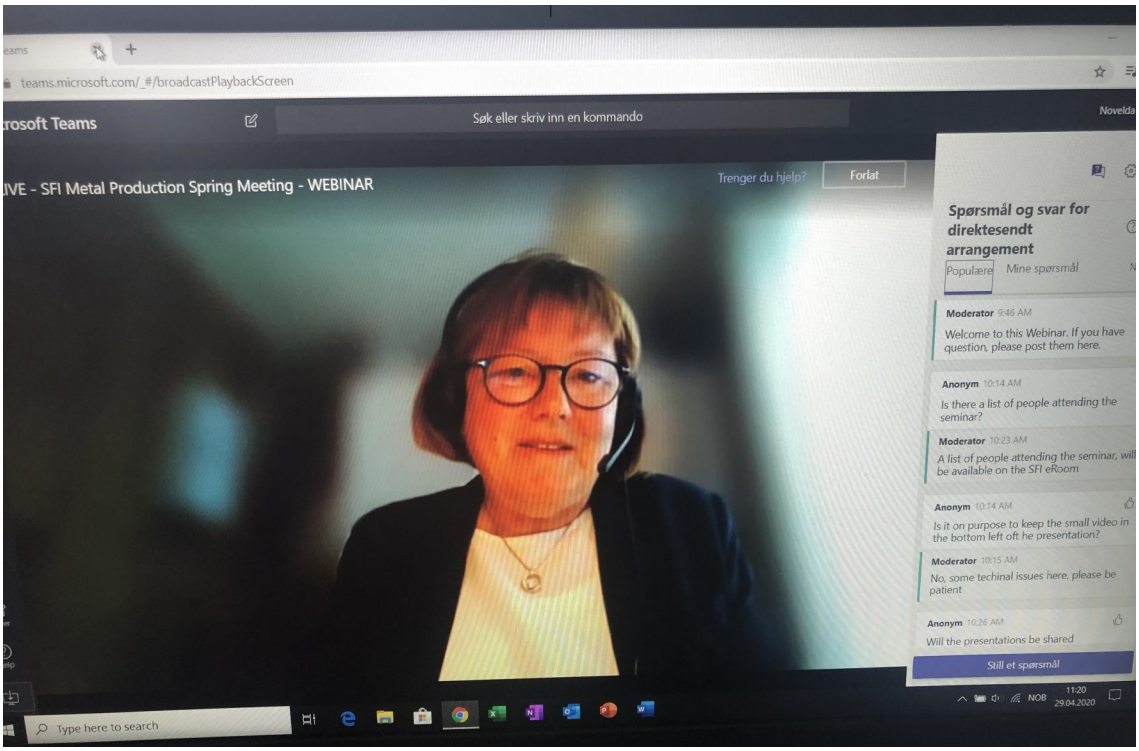
Aluminium - recovery of surplus bath and processing of SPL. RD4) Emissions focused on sensors for monitoring dust emissions in the industry, and modelling of scaling in off-gas systems. The Webinar was closing with a presentation on the topic of the "Beginning and the End of the Aluminium Value Chain" – and the need for closed loop in the production and use of aluminium.

SINTEF in-kind acitivity in the center

The seminar continued with presentations on SINTEF in-kind activity in the center – 1) SlagStruc: A new modelling Framework for slag microstructure and properties and 2) Improved yield in metal production using controlled wetting - Case: FeMn metal production. Both topics are highly relevant for the work in the Centre in RD2 Primary Metal Production.

Positive effect of online meetings —easily available for more participants

Ketil Rye, Process Technology Manager at Alcoa, congratulated the centre on a very well-organized agenda and a professional performance in the SFI Spring Webinar: “Alcoa had more than 15 direct participant and even more clustered around their computers to watch the latest news from the activities in Trondheim. Making the spring meeting as a webinar enabled a very good dissemination of results in spite of the present travel restrictions.»



Centre manager Aud Wærnes closed the meeting and concluded that we are happy to have online solutions in times of major restrictions due to the corona pandemic. We see that there are advantages when participants can follow the talks from their (home) offices. We will evaluate the webinar together with the participants, and we feel confident that webinars can be a very good supplement to future meetings for the Centre.

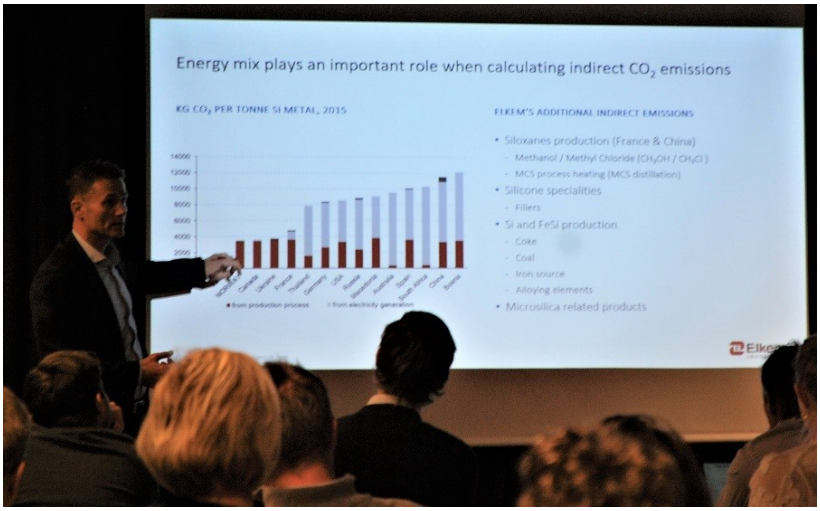
GREEN DEAL –seminar

Oslo February 2020

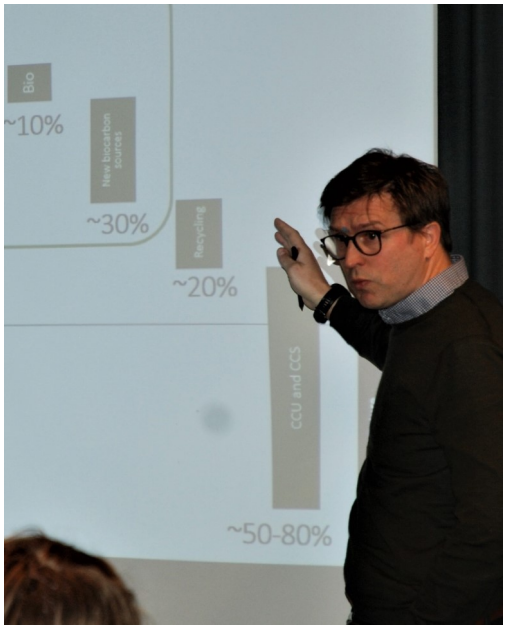
Norwegian industry is tightly connected to Europe through power trading. How is the power market system connected to the vision of a clean industry? How will «Green Deal» affect Norwegian industry? Are we able to reach the goals defined in the government's roadmap for the process industry by 2050? These questions were addressed at an all-day seminar in Oslo February 4th.

The seminar was organized by Bellona, The Norwegian Ferroalloy Producers Research Association (FFF), Process21 and SFI Metal Production. On the agenda were Norwegian process industry, the market-based power system and the EU commission's new "Green Deal".

Participants from industry and research and government institutions had interesting discussions and listened to presentations from Bellona, Eramet, Finnfjord, Wacker, Elkem and Alcoa.



Elkem presented their plan for reduced CO2 emission.



Ole Løfsnæs from Alcoa talked about the Norwegian power market.

Jonas Helseth from the Bellona office in Brussels gave insight on how Norwegian stakeholders can play a role in shaping EU legislation. The European Union makes laws for all EU and EEA countries (including Norway) on matters relevant for the process industry. Helseth described how Bellona works to influence the European response to climate change and he encouraged the participants to engage in the policy processes. Norwegian industry is among the cleanest industries worldwide, and we have a responsibility to stimulate green actions internationally.

FFF and Bellona have been cooperating for many years, and a follow-up seminar is scheduled for the autumn 2020.

Important events coming up

August - December 2020 SFI Metal Production Webinar series. 45-minutes presentations on the topics Silicon, Manganese and Aluminium.

September 3, 2020 SFI Metal Production Innovation strategy seminar. Participants from all research- and industry partners. Trondheim/webinar.

September 10, 2020 Public (online) defense of doctoral thesis – Sethulakshmy Jayakumari. Sethulakshmy Jayakumari is defending her thesis as part of her doctoral work at NTNU: "Formation and characterization of β-and α-Silicon Carbide produced during Silicon/ Ferrosilicon process" Trondheim/online.

November 3-4, 2020 SFI Metal Production Autumn Meeting. Trondheim.

November 5, 2020 Dross seminar 09:00-13:30. Trondheim.

For more information on the events, see SFI Metal Production website.

metal production

sfi Senter for forskningsdrevet innovasjon
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