Keynote Session

Johan Eriksson
Swerea Industrial Recycling –
A Swedish initiative on recycling

Johan Eriksson, Swerea MEFOS
Swerea MEFOS

Areas of competence
Process metallurgy, heating and metal working recycling, environment, energy/material efficient iron-, steel- and base metal processes

Employees: 98 (2013)
Pilot equipment

Process metallurgy

Heating and metalworking
Latest equipment: Fluid bed reactor

Technical data - Fluid bed reactor
Roaster: Ø = 200mm, h = 2000mm
Freeboard: Ø = 300mm, h = 6000mm
Max temperature: < 1000°C.
Kapacity: 20-50kg/h.

Applications
- Drying
- Kalcination
- Reduction
- Roasting (oxidation)
- Gasification (bio-fules)
- Catalytic Combustion
- Bed materials
- Heat recovery
What’s going on globally…

… and influencing Swerea MEFOS activities

• **Competition for raw materials**

• **Energy** – cost and GHG

• **Environment and sustainability**

• **New materials** for lighter constructions
Sourcing of raw materials

- **New raw materials**
  - usually lower grades

- **Secondary raw materials**
  - recovery from e.g. dust, sludge, scale, slag, tales

- **Tertiary materials**
  - development of alternative materials
Recycling using metallurgical reactors

- **Converter (5 ton)**
- **DC-furnace (3 MW)**
- **AC-furnace (10 ton)**
- **DC-furnace (3MW)**
Examples of projects

- Vanadium extraction from steelmaking slags (from lab.trials to full scale)
- Recycling of BF dust through BF-injection (implemented at SSAB 2012)
- Regeneration of hydroxide sludge (lab/pilot/full scale trials, in production since 2008)
- Zinc recycling from EAF dust (different tested concepts in pilot- and full scale)
- Use of rest energy from liquid slag (on-going work, dry granulation)
- Melting reduction in DC-furnace (slags, dusts, vanadium containing ashes et c.)
The Swerea Group

**Swerea MEFOS**
Process metallurgy, heat treatment, metalworking, energy efficiency, environmental engineering

**Swerea IVF**
Industrial product development, textiles, polymers, ceramics

**Swerea KIMAB**
Material use, material and process development, corrosion

**Swerea SICOMP**
Composite materials, process and product development

**Swerea SWECAST**
Cast metals – products, materials, process and environment development
Swerea IVF

Areas of competence
Production efficiency, Industrial product development, Eco-design, Process- and material development within:
Textiles, Polymers, Metals and Ceramics.

Employees: 155 (2011)
Swerea KIMAB

Areas of competence
Development of Processes-, Alloys-, Material properties, Production, Corrosion protection and Recycling

Employees: 185 (2011)
Swerea SICOMP

Areas of competence
Composite materials:
Material science, Process simulations and Manufacturing technology

Employees: 43 (2013)
Swerea SWECAST
the Swedish foundry industry’s institute for development and education.

Areas of competence
Production technology, casting simulation, Energy-, Environmental- and Material technology.

Special areas:
- Casted light weight multifunctional components
- Sustainable production

Employees: 55 (2011)
Collaborative project

All institutes within Swerea promotes **increased internal recycling** by developing new methods et c. within their respective areas.

By joining our cross-industry expertise, Swerea can create **new innovations** and **comprehensive** solutions.

The work is focusing on the part of the total value chain, where the waste/by-products are generated until they are recycled.
Examples of collaborative projects

Quick Flux

Recycling of aluminium dross (from secondary Al-smelting and foundries) and converting the dross into slag fluxes for steelmaking.

Protect

Combined surface cleaning and pre-heating of galvanised steel scrap by using wastes plastic, e.g. ASR. Resulting in zinc chlorides and clean warm scrap.
Recycling metallic wastes to foundries

Development of techniques and methods for small foundries to recycle wastes to induction furnaces and similar processes.

New projects …

Recently several minor studies have been started up. The objectives with these studies is to identify new solutions to utilise wastes/by-products as raw materials in new applications within other industrial sectors.
The Swerea Group – one step further

Swerea MEFOS
- Process metallurgy
- Metal working
- Heating

Swerea IVF
- Production technique
- Ceramics
- Textiles

Swerea KIMAB
- Corrosion
- Materials properties
- Analysis

Swerea SICOMP
- Plastic
- Composites

Swerea SWECAST
- Castings
- Foundry

Swedens strongest R&TD-team on Industrial Recycling of Material

The Swerea Group – one step further
Swedish National research

Strategic Areas of Innovation

A national aim is to promote Innovation, Education and Entrepreneurship in Sweden.

The Industry, Academy and Institutes have started a number of strategic areas of innovation within the following areas:
- Mining
- Metallic materials
- Production
- Process automation and IT
- Light weight materials

The Swerea institutes are involved within all these strategic areas.
European research – HORIZON 2020

Aims for Europe
- Excellent Science
- Industrial leadership
- Societal challenges:
  ... and “climate action, resource efficiency and raw materials”

Will run between 2014-2020 with a total budget of 70 Billion euros.
European research – HORIZON 2020

Different initiatives


KIC Raw Materials – Knowledge Innovation Centre, proposed to start 2015. Primary raw material (European miners) Secondary raw materials Tertiary raw materials (substitution)
In cross-over solutions can often the major breakthroughs be found.
Keynote Session

Matt Williams
If you build it, they will come....
Trials and Tribulations of Using New Materials
Matt Williams
Sustainability Manager, Building NSW & ACT, Lend Lease
Some examples of how we can drive materials innovation

1. Developing an existing product
2. Using a new product
3. Measuring the impact of products
Innovation comes from the producer - not from the customer.

W. Edwards Deming
What if we want to develop a better product?

- We needed a ‘sustainable’ composite timber product that was 100% post-consumer recycled, low formaldehyde, to be used for all composite timber applications in the fitout, including workstations.

- We wanted an innovative partition wall system with high recycled material content, that could be used in curved walls and had good acoustic properties.
Using 100% recycled timber board

- D&R Henderson produced the product in Benalla, Victoria. The recycled timber came mostly from pallets, doors and door frames.

- The recycled timber had to be kept separate throughout the process and a large quantity of contaminants meant high personal attention and machine maintenance was required.

- The product was successfully used for joinery, doors, bulkheads and workstations.
The manufacturing process

- Wood waste typically makes up 8-12% of raw materials.

- The ring flaker, which smashes the wood into fines, has blades that usually wear over 24 to 48 hours of production.

- With 100% recycled product the blades lasted only 30 mins to 2 hours.

- This leads to excessive costs meaning the product is not economically viable. It also meant the surface quality was poor so we had some issues with getting the veneer to stick to it.
Lightweight Concrete
Lightweight Concrete - ecoMixcrete

- Contains 70% post-consumer/post-industrial content by volume through use of:
  - Sawdust and woodchips from the milling process of green logs
  - Waste Perlite as a by-product of regular perlite manufacture that would go to landfill
  - Waste Polystyrene from food packaging boxes crushed into a powder
  - Cement with 20% flyash content

- Differs from all other concrete/cement products: very lightweight, fire resistant, thermally and acoustically high performing, impact resistant

- Custom designed & used for the first time in cast in situ partitions in Australia.
Innovation distinguishes between a leader and a follower.

Steve Jobs
What if we want to use a new product?

- Our Architectural Engineering team provide expertise around
  - Construction Code application
  - Fire Engineering
  - Waterproofing
  - Acoustic Design
  - Construction detailing and architectural finishes
  - Managing Delivery Risk

- Using a new product requires a huge investment in testing, authority approvals and a high level commitment from the business
Take Cross Laminated Timber (CLT)…..
Fire testing

AS1530 Part 4 (equivalent to BS 476 Part 21 Determination of the fire resistance of load bearing elements of construction)

- FR 90/90/90: 128mm wall panel with 13mm fire grade plasterboard direct fixed
- FR 90/90/90: 158mm wall panel - bare
- FR 120/120/120: 146mm floor panel with 2 layers 16mm fire grade p’board direct fixed
Acoustic Design

– Equal or higher than conventional concrete frame / masonry / plasterboard wall
– Focus on low frequency – need to add mass via floor build up
– Australia has high code requirements
– Lend Lease has higher than code standards
Moisture and Vermin Protection

– Rain screen facade
– Moisture content should be around 12%.
– Controlled “By Design”.
– CLT protected by sarking and cladding.
– Ventilation cavity draws heat away from the timber.

- BRE has certified CLT for a 60 year design life

- CLT structure sits on a concrete podium for ground separation for physical termite protection
Forte Apartments, Victoria Harbour

- The world’s tallest timber apartment building
- First CLT building in Australia
- First Lend Lease Australia project to incorporate pre-fabricated pods
- First Lend Lease 5 Star Green Star As-Built Residential rating
Forte Apartments, Victoria Harbour
To measure is to know

Lord Kelvin
Our carbon commitment at Barangaroo

- Reduce the embodied carbon per square metre of the base building for each Works Portion, by 20% compared to ‘standard construction practice’

- This is about the same as:

  - 5 years of base building operational emissions
  - 2,000,000 barrels of oil
  - 2 million trees grown for 10 years
  - 370 railcars of coal
  - 1,134 tankers of petroleum
  - Annual emissions of 18,000 cars
  - 1 min 7 secs of global emissions!
Boundary Definition

- Benchmarking is complex – many unique attributes
- Compare Barangaroo with Barangaroo
- Define standard construction materials
- Identify unique planning & design initiatives
The majority of impact is from the manufacture of products and materials (90%). Transport is less significant.

Onsite construction is dominated by emissions from purchased electricity ~70% with the balance coming from liquid fuels particularly diesel.

Structural elements represent 55% of the impact followed by façade 20%, floor and ceiling finishes 11%.

Opportunities to affect reductions diminish once you move beyond these core elements.
Initiatives

- Concrete
- Reinforcing
- Façade
- Access Floors
- Stremaform
- Onsite Batching
Impacts

-20%
Summary

- We develop products with existing suppliers through trials and experimentation that might lead to new opportunities for them and for us.

- We apply our expertise to investigate whether a new product might be suitable for the Australian market which might require testing for the benefit of the wider industry.

- We leverage supplier improvements in manufacturing processes, along with our design smarts, to reduce the environmental impact of our buildings.
How times change……

We must find new lands from which we can easily obtain raw materials and at the same time exploit the cheap slave labour that is available from the natives of the colonies. The colonies would also provide a dumping ground for the surplus goods produced in our factories.

Cecil Rhodes, 1890
Keynote Session

Nigel Lake
Innovate or Die!
2013 International Sustainability Symposium | UNSW | October 2013

Nigel Lake | Pottinger.com | Twitter: @Nigel_Lake
We cannot solve our problems with the same thinking we used when we created them.

- Albert Einstein
Take the 2% challenge
Embrace uncertainty
Burn the base case
Introducing Jorgen’s frog

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