KME workshop with energy utilities and researchers

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Place Energiforsk

Participants

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Patrik Schneider	Kraftringen
Jasmin Aspen	Kraftringen
Per Tunberg	Mälarenergi
Rikard Norling	Swerea KIMAB
Pamela Henderson	Vattenfall
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Introduction

BW and ES made an introduction to the workshop, presentation in annex 1. The aim of the workshop was to:

- Identify the energy utilities material related problem areas, and what would need to be solved
- How could the research contribute to solve the problems
- Identify possible project ideas/areas
- How the companies could implement and utilise the results and how the information dissemination could be improved.

The results from the workshop

- will form the basis for further project discussion with boiler and material manufacturing companies
- will be included in the elaboration of KME programme description.

The energy utilities material related challenges.

Mälarenergi

Mälarenergi's presentation of their material related problems and areas of interest in annex 2.

Generally, Mälarenergi is facing a new situation in near term future with flexible operation and more frequent start and stop (more than 10/year?).

Block 6, waste, challenges:

- Empty draft, thermally sprayed (720°C) IN 625 is spalling off, due to erosion (corrosion?).
- Vortex tube, large material loss of uncooled material in 900°C environment (252 material)
- FGT, erosion protection flue gas/fly ash, material loss of Hardox coated components

Block 7 new block, recycled wood and waste, challenges:

- Hot flue gases 850°C with high velocity, including led and zinc, effects on boiler surfaces of 300°C. Erosion/corrosion.
- Follow up programme on corrosion and erosion in new plant, is it according to schemes (programmes)?
- Erosion in cyclone

Panna 5, biofuel and recycled wood, challenges:

- Development of refractory lining to meet future demands with flexible operation with starts and stops (10-15 starts/year) and fast ramping.
- Refractory lining is spalling off. Possible to replace the refractory with other materials or other coating technology (beläggningsteknik)

EON

Several common questions and interests with Mälarenergi:

- Cyclone (vortex tube), short life time. 253-MA material. Is it know what causes the problems?
- IGS has coated IN 625 (thermal spraying) in Örebro. Programme for testing and follow up.
- Alternative materials to refractory lining, IN 625 in furnace wall? Eon is building a grate fired boiler for waste without refractory lining, which instead is coated with IN 625. Aim to give high availability and low OpEx.
- Difficult to make exposure test and to find cracks; how to investigate and assess the lining?

Eon interests and challenges:

- Waste fired boilers, p14 and p15 at Händelö, Nörrköping
- Cost effective solutions for SH (sand loop seal and convection). Not always better and more expensive materials. Predictable materials
- Vortex tubes. Severe material loss.
- Nozzles for primary air. Relation erosion, corrosion temperature and materials. Develop materials for the nozzles.

Fortum Heat

Fortum plans for a larger mix of fuels (wastes) and several products in different timing (electricity, heat, ashes…), and have the following interests:

- There is a need to understand the effects of changes in fuel mix; corrosion memory effects.
- Measurement methods, to enable understanding of total economy for a fuel, i.e. understand the effects of a changes in fuel in terms of fouling, corrosion etc, and costs.
- New fuels in boilers, recycled wood in the new plant in Värtan (KV8, 140 bar/560°C)
- Alternatives to refractory lining.
- Superheaters, both convection and sand loop seal.

Kraftringen

The Örtofta plant is going well. However, new prerequisites of low electricity prices and low district heating demand, call for changes in operation (mainly cheaper fuels). Challenges and areas of interest:

- High availability.
- Aim is to increase the fraction of recycled wood, from today's 45 % to over 50 % at the same time as remove peat as fuel. (dosage of Sulphur instead of peat). Problems will most probably come.
- Nozzles, high material loss due to increased fraction recycled wood.

Jämtkraft

Their plant, a FW boiler is going well (125 MW, 145 bar/545°C, built 2002, fuel 25 % recycled wood, dosage of Sulphur, Esshete material in SH). Initial problems with material loss in nozzles, but they are now changed with new stones, which works much better. The prerequisites with low electricity prices, call for an increased amount of recycled wood. Area of interest:

- Increased fraction of recycled wood, is it possible? Effects of increased fraction and where is the limit?

The researchers perspective and ways to combat problems

Chalmers/HTC

Chalmers/HTC presented examples on how they work with corrosion related problems in CHP plants. It is often through a combination of projects, where the fundamental understanding of corrosion phenomena (via HTC normally) to more applied field testing in plants via KME. This broad approach have led to short implementation time from idea to product. **Presentation appendix 3**

Vattenfall

Vattenfall presented their successful work mainly directed towards water wall corrosion. Their BFB boiler (no sand loop seal, steam data 140/540) had previously severe problems with water wall corrosion (high material loss), primarily due to an increased fractions of recycled wood. No significant problems in SH (stainless steel and ChlorOut). **Presentation appendix 4**

Swerea KIMAB

Within KME, Swerea KIMAB contributes to study and solve important problems for the utilities. Current work in KME includes non-stick protective coatings in metal-polymer composites to minimise the fouling/deposits, tests of fuel additives, such as sewage sludge, to reduce the corrosion for various fuels, studies of boiler corrosion and influence of lead and zinc and their chlorides when using recycled wood. **Presentation appendix 5**

Discussion of relevant problem areas

It was noted, that the boiler manufacturing companies and the energy companies (utilities) might have a slightly different perspective; however both perspectives can be combined in projects.

- Utilities – promote availability
- Boiler manufacturing companies – promote performance (efficiency)

High priority for utilities

General questions

- The risk with increased fraction of recycled wood, and how to minimise the risks. Shared by all utilities.
- Material handbook, a handbook similar to Värmeforsk bränslehandbok would be useful.
- Equilibrium calculations, tools for prediction a fuels' corrosiveness. The relation fuel – corrosion.

Nozzles

- Put together experiences. Work done in P6 Högdalen, Fortum/KIMAB.
- Understanding of the relation erosion, corrosion, temperature and materials.
- Construction solution and design (and effects from welding, casting).
- Material development and selection. Material tests in boiler manufacture's design.

Furnace wall

Refractory lining

- Quality assurance of the practical work to apply refractory lining (murning) and estimation and assessment of status after operation.
- Assessment of status. How to detect cracks, spallation, corrosion, etc?
- The area is rather unexplored and limited experience and knowledge at researchers.
- Companies doing the practical work (murfirmor) could be involved.

- Replacement of refractory lining with other materials – "naked tubes"; systematic test of coatings in different types of boilers and environments.

Corrosion of water/furnace wall
- Possible pressure and temperature for a specific fuel mix.
- Fuel mix, find/detect limit for a certain fuel.
- Led corrosion.

Vortex tubes
- Uncooled components/parts
- Possibility to use FeCrAl
- "Hanging probes" for initial tests of corrosion and materials.
- Investigate the mechanism for failure; thermomechanical fatigue, erosion?

Superheater

Convection SH
- Cost effective materials
- Long-term test with tubes
- Material handbook
- Corrosion memory

Sand loop seal SH
- Support of tubes as well as tubes
- Understanding of environment and phenomena for material loss
- Gas measurement + effects of additives
- Tests with probes
- Short-term test

Medium priority

Empty pass
- Flue gas temperature
- Sprayed IN 625 is spalling off, what are the alternatives (San 28/IN 625/FeCrAl)
- Project could include tests with spray on surfaces that is exposed in real environment, different materials with different spray methods.

Air preheater
- Low temperature corrosion, probably higher priority for boiler manufactures. Aim at higher electrical efficiency. Topic is still generally relevant and could be included in projects.

Not discussed

Due to time constrains, the following were not discussed
- Digitalisation
- Recovery and recycling of waste/material streams and material in ash

Minutes by
Bertil Wahlund