

HTC

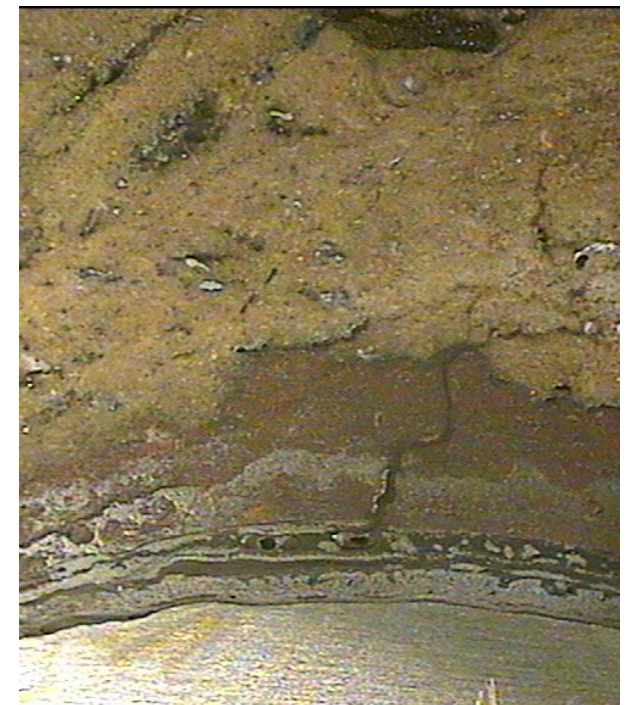
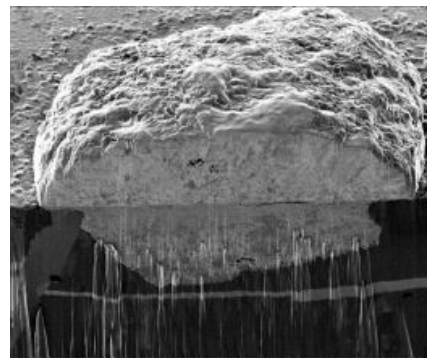
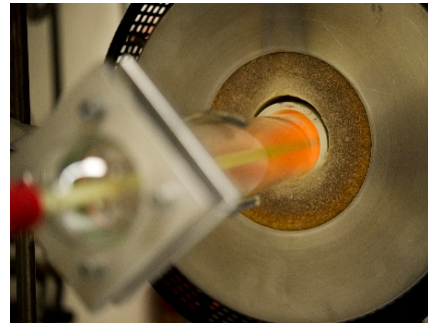
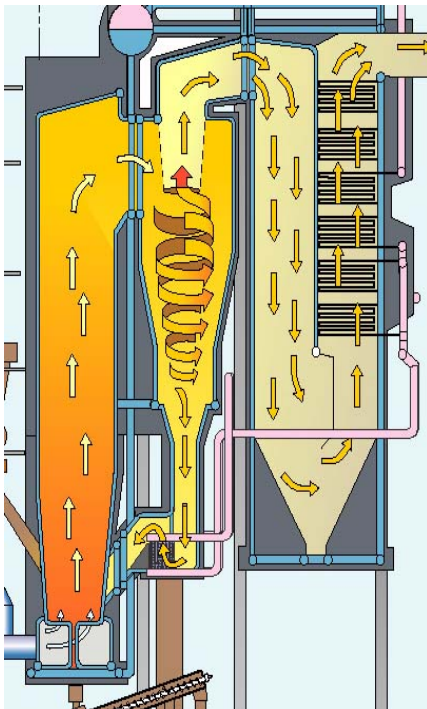


The High Temperature Corrosion Centre



Research for a sustainable society

2014 - 2017



Vision and Challenges

HTC's shall contribute to the development of a sustainable energy system by providing a world-leading environment for high temperature corrosion research

Our main challenges:

- Form a common platform for university researchers in different areas *and* industry R&D workers
- The research has to be both scientifically world-class *and* useful to industry and society

**21 member
companies**

**Swedish Energy
Agency**



**The
High-Temperature
Corrosion Center**

Chalmers

KTH

Swerea-KIMAB

Swerea-IVF

The member companies



- Sandvik Materials Technology
- Sandvik Heating Technology



- Valmet
- FosterWheeler
- Völund
- Andritz
- Cortus
- Janfire
- Nibe
- Castolin



- Haldor Topsoe
- GKN Aerospace
- Siemens
- Entech
- Powercell

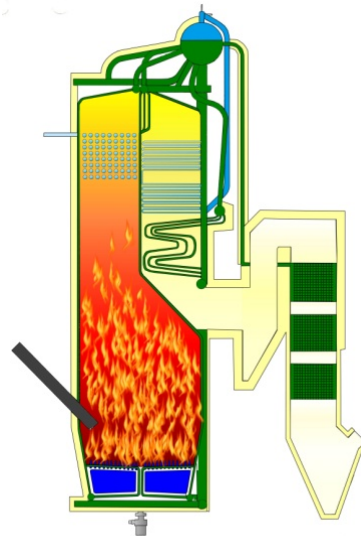
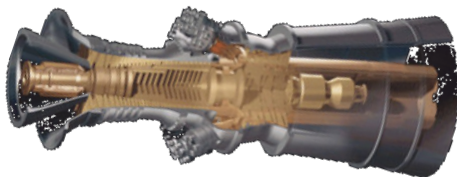


ENERGIFORSK
representing:

- Vattenfall
- EON Värme
- Fortum Värme
- Tekn. V. Linköp.
- Mälarenergi
- Göteborg Energi

Research areas

- Renewable fuels – increasing the efficiency of power generation and gasification
- New corrosion resistant materials for tomorrow's energy system
- Energy conversion

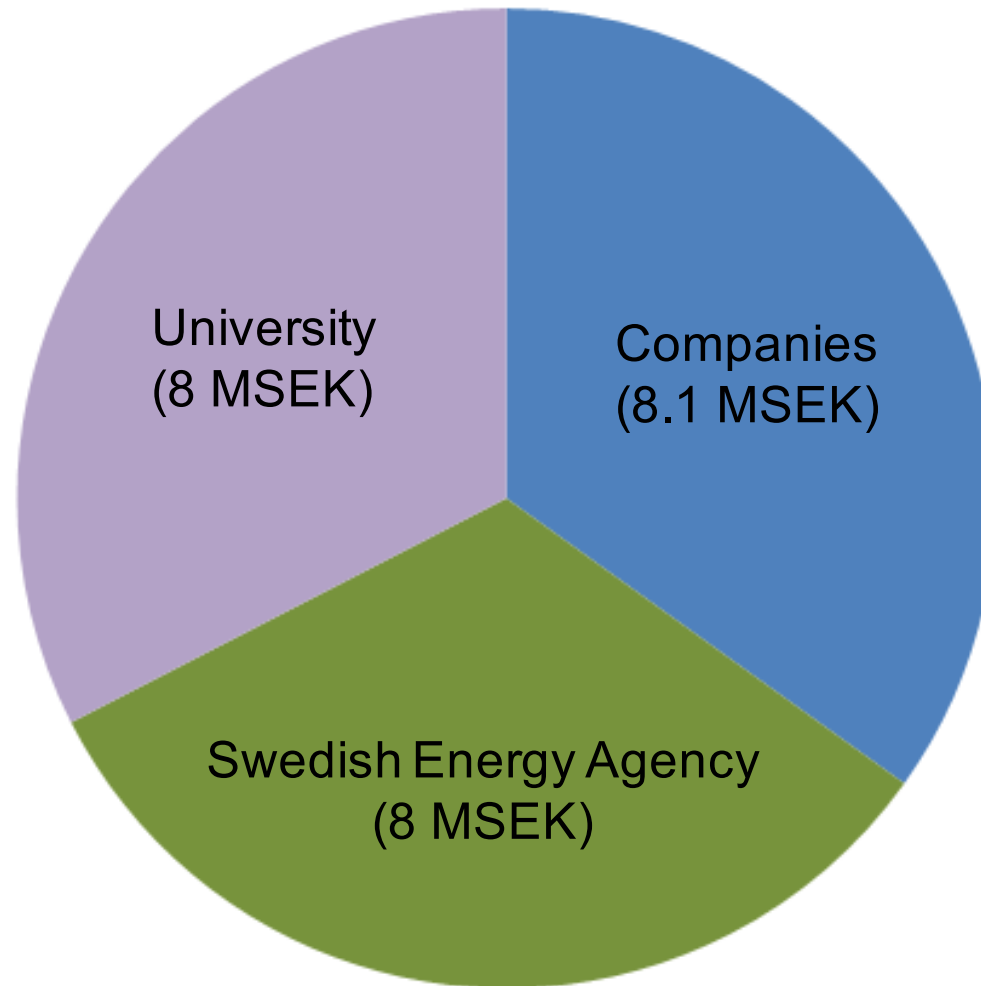


HTC in short

- About 15 Ph.D. students, 20 Senior researchers and 3 Adjunct professors
- A total of 40 Ph.D. degrees from 2002 to present
- In 2014-2015: 5 Ph.D exams, 5 licentiate exams and 36 scientific papers in peer-reviewed journals



HTC Financing (cash + in-kind contribution)



Total cash financing of University research 12 MSEK/year

Six HTC projects:

Critical corrosion phenomena in combustion of biomass and waste

(J. Liske)

High temperature corrosion during gasification of biomass and waste

(R. Norling)

Oxidation assisted crack growth in gas turbine materials

(K. Stiller)

High temperature oxidation of superalloys for gas turbines in oxyfuel envir.

(M. Halvarsson)

High temperature materials in the process industry

(J.E. Svensson)

*Corrosion and oxidation of FeCr alloys for solid oxide fuel cells (SOFC)
and solid oxide electrolysis cells (SOEC)*

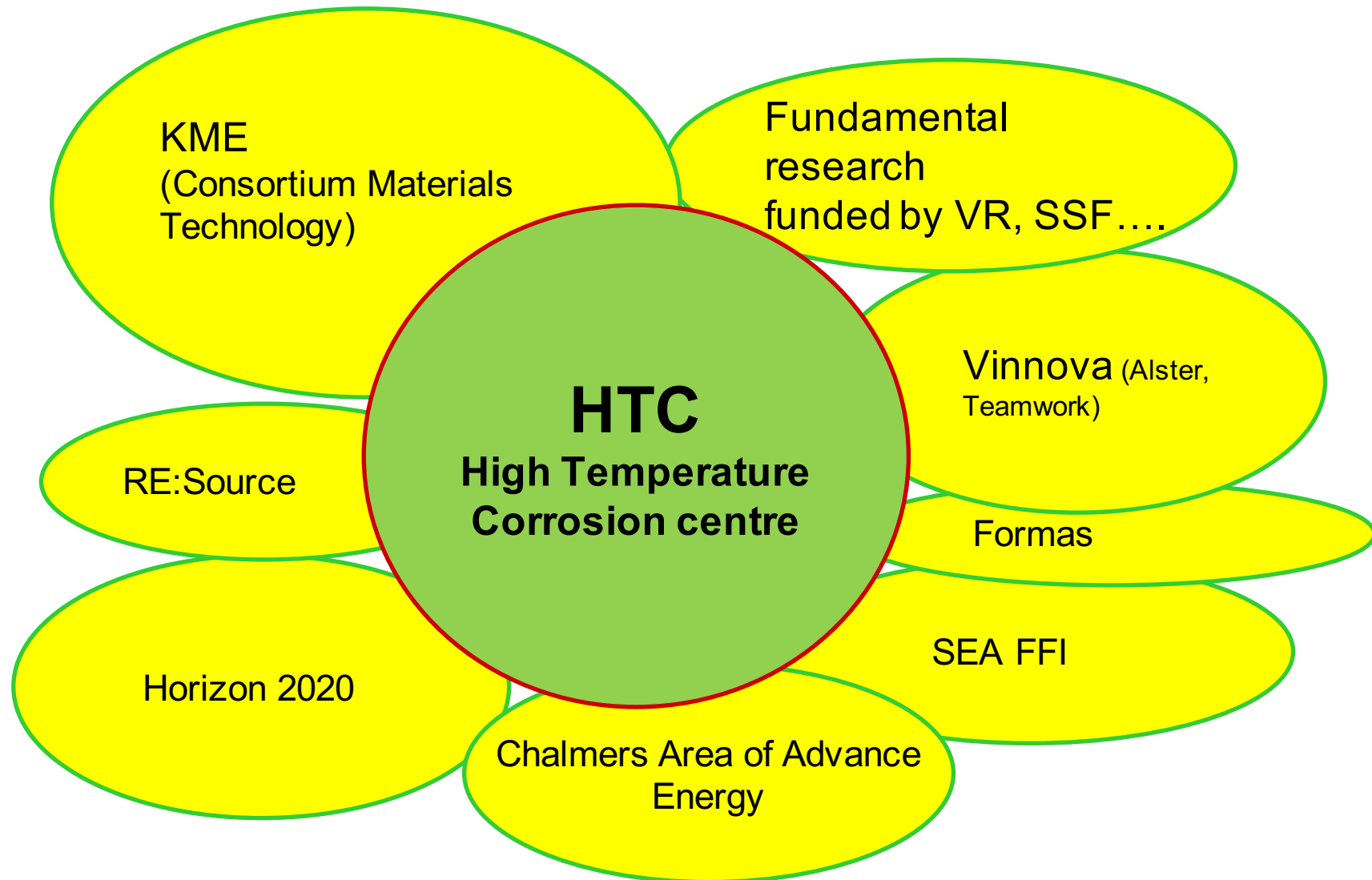
(J. Froitzheim)

Research partners at universities and institutes

- *Area of Advance Energy, Chalmers*
- *Energy & Materials, Chalmers*
- *Materials Microstructure, Chalmers*
- *Surface and Corrosion Science, KTH*
- *Corrosion, Swerea-KIMAB*
- *Ceramic materials, Swerea-IVF*



HTC is the nucleus of a Swedish research cluster in its field



International collaborations

Scandinavia



UNIVERSITETET
I OSLO



Risø DTU
National Laboratory
for Sustainable Energy



Europe



UNIVERSITÉ DE
GRENOBLE



University
of
St Andrews

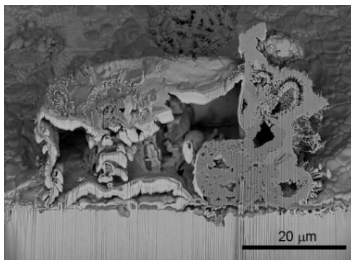


World



Research strategy

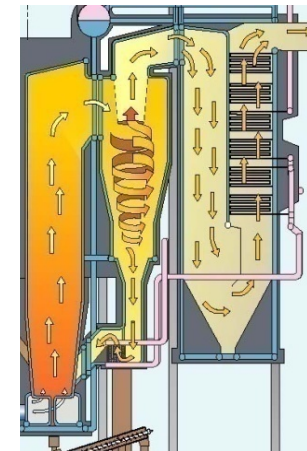
Fundamental research



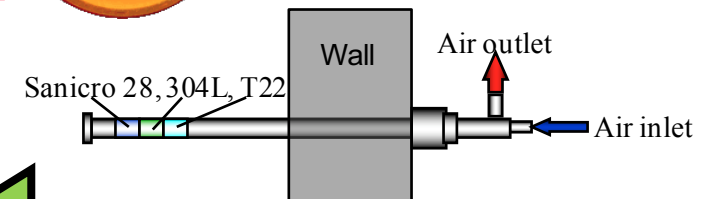
Lab experiments +
Post analysis (FIB,
BIB, SEM, TEM...)
TD calculations
1st principles
calculations

Corrosion
mechanisms

**Mitigation of
corrosion!**



Corrosion
in real
applications



Applied research

In-plant experiments
rig and stack tests

HTC has been around for 20 years; so what's new?

- Greater focus on solving corrosion problems
- Closer collaboration with the companies
- New scientific approaches
 - i. Modeling of corrosion processes by 1st principles calculations
 - ii. Thermodynamic and kinetic modelling of oxide growth
- New and extended exposure facilities
 - i. Low oxygen activity, ($\text{H}_2/\text{H}_2\text{O}$, CO/CO_2 , CH_4), dual atmosphere
 - ii. Much greater capacity for corrosive gases (HCl , SO_2), thermobalances...
- Novel post analysis techniques
 - i. Broad Ion Beam milling (BIB)
 - ii. High resolution TEM/EDS/TKD
 - iii. Nano-SIMS
 - iv. Atom Probe (ATP)

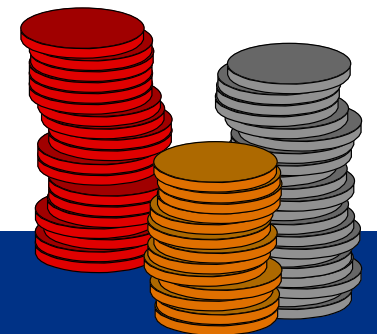




HTC is a link between industry and university!

The drivers behind the co-operation:

- **University:** Generate new scientific knowledge and publish
- **Industry:** Use the new knowledge to increase company profit
- HTC's is a common platform for university researchers and industry R&D. HTC research which is both world class scientifically and useful for industry





Our Mission:

The programme is focused on the following areas:

- Renewable fuels – increasing the efficiency of power production and gasification
- Corrosion resistant materials for the energy system of the future
- Energy conversion

