HiAl Biofuels for CHP Plants

Reduced Emissions and Cost reduction in the Combustion of High Alkali Biofuels

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BIO-ENERGY
ENLARGED PERSPECTIVES

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Technical aspects of HIAL biofuel combustion - problems to be solved -

Grate, Fluidized bed, Suspension

High temperature corrosion of heat exchangers

High slagging and fouling propensity

Relatively high emissions of NO_x, SO_2 and HCl

current emissions for grate: 300 mg/Nm^3 SO_2
200 mg/Nm^3 HCl
400 mg/Nm^3 NO_x

Aims of the Project

- Fundamental understanding of combustion and release
  - Grate firing
  - Suspension firing
  - Fluidised-bed combustion
  - Mass spectrometry
  - Modelling
- Reduced SO_2 emissions in grate firing by >33% (<200 mg/Nm^3)
- New designs for grate-fired CHP plants with lower installation costs and running costs

Consortium of the Project

City University London

Suspension firing

Tech-wise

energy, environment, knowledge.

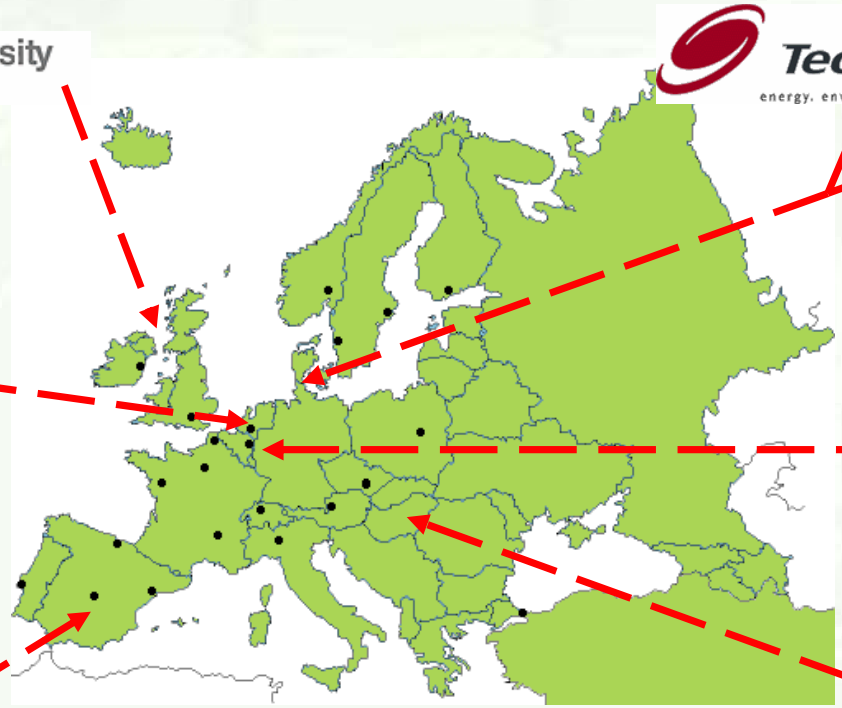
DTU

Grate firing

TU Delft

Delft University of Technology

CFBC

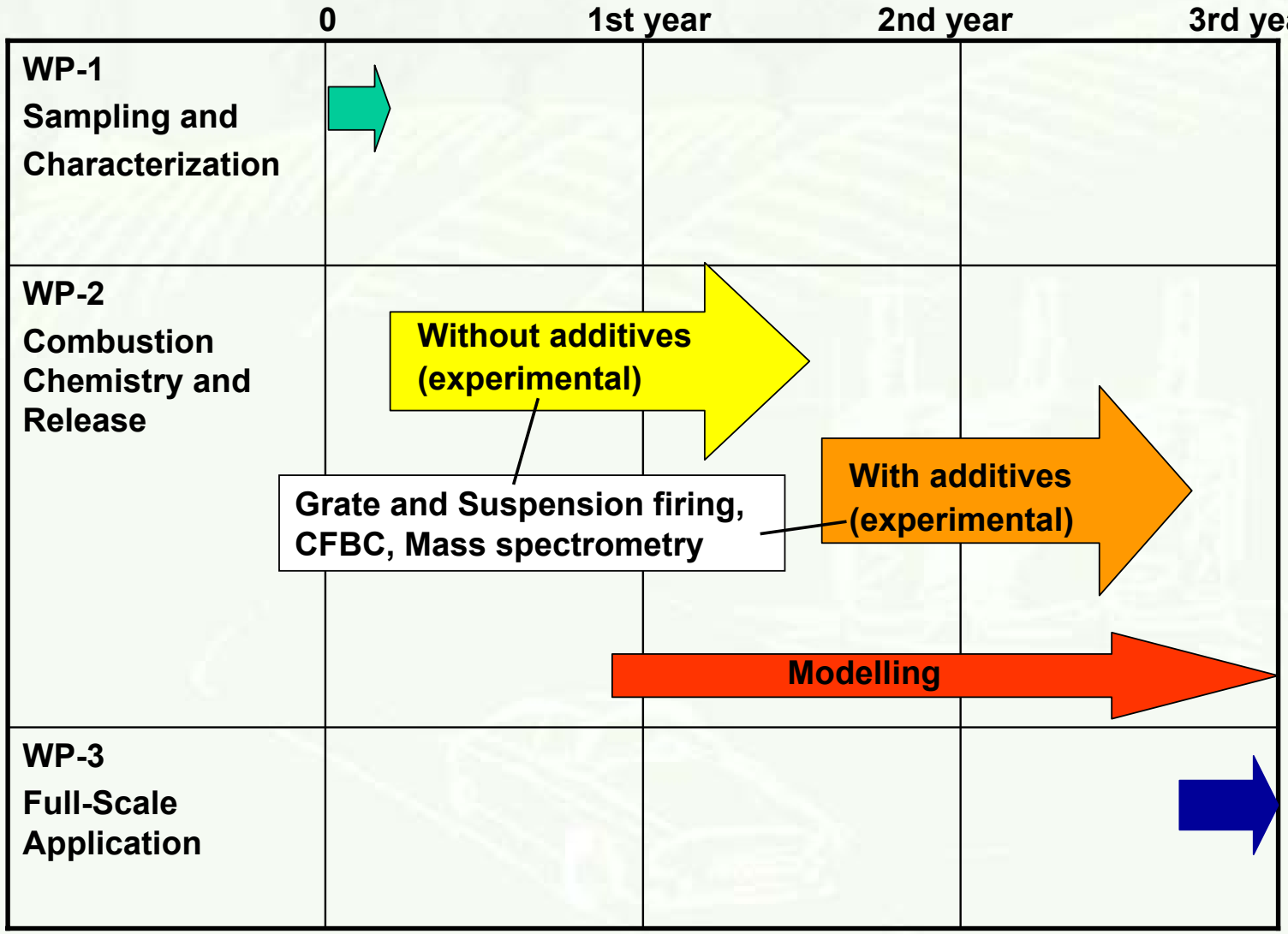


Mass spectrom.

EHN

Modelling

Timetable


0
1st year
2nd year
3rd year
WP-1
Sampling and
Characterization
WP-2
Combustion
Chemistry and
Release
Without additives
(experimental)
Grate and Suspension firing,
CFBC, Mass spectrometry
With additives
(experimental)
Modelling
WP-3
Full-Scale
Application

Samples

Spain:
HIAL 1- Rice
HIAL 2 - Oats
HIAL 3 - Wheat Marius
HIAL 4 - Rape
HIAL 5 - Winter barley
HIAL 6 - Wheat Soisson
HIAL 7 - Carinata
HIAL 8 - Spring barley
HIAL 9 - Maize

12 samples

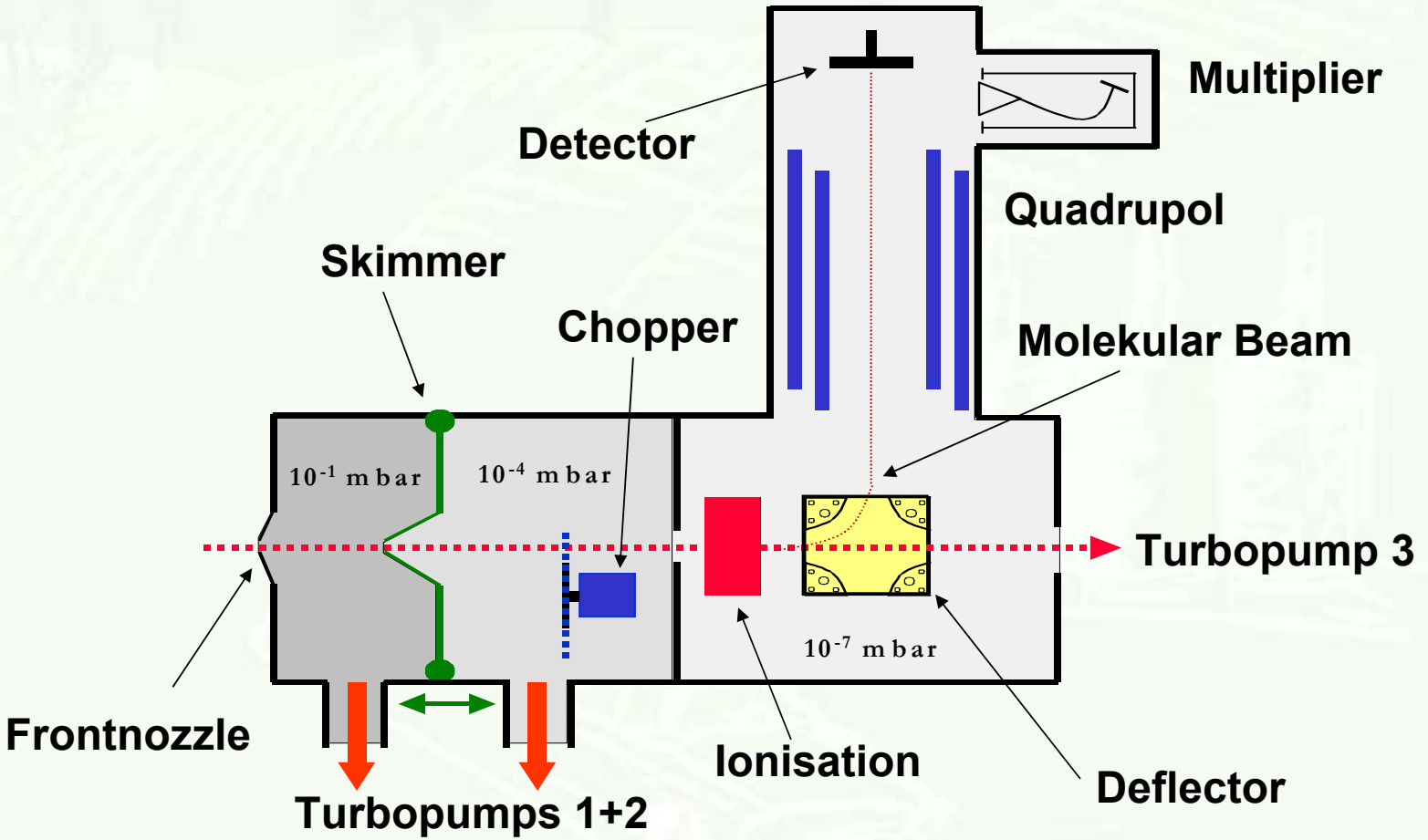
Denmark:
HIAL 10 - Wheat 2000
HIAL 11 - Wheat 2001
HIAL 12 - Barley 2001

4 key samples

Sample	Straw type	Characteristics	K/Si-ratio	S/Cl-ratio	K/Cl-ratio
HIAL 10	Danish wheat (2000)	Typical composition	0.9	0.5	4.3
HIAL 5	Spanish winter barley	High in K and Cl	3.0	0.2	2.2
HIAL 2	Spanish oats	Low in K, Cl and Si	2.1	2.7	10.2
HIAL 7	Spanish Carinata	High in K and S Low in Si and Cl	28	4.7	28

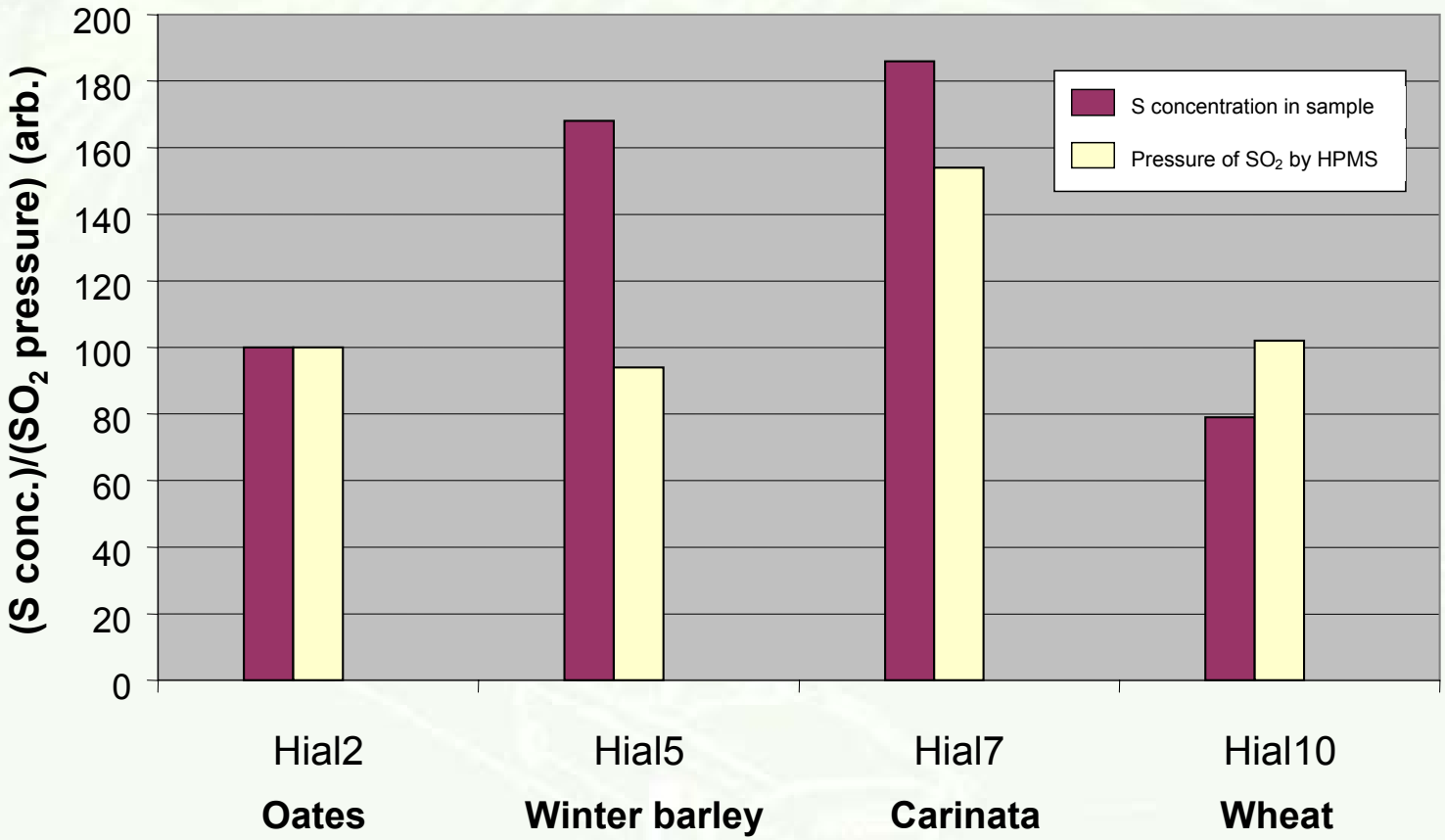
High Pressure Mass Spectrometer

(Research Centre Jülich)



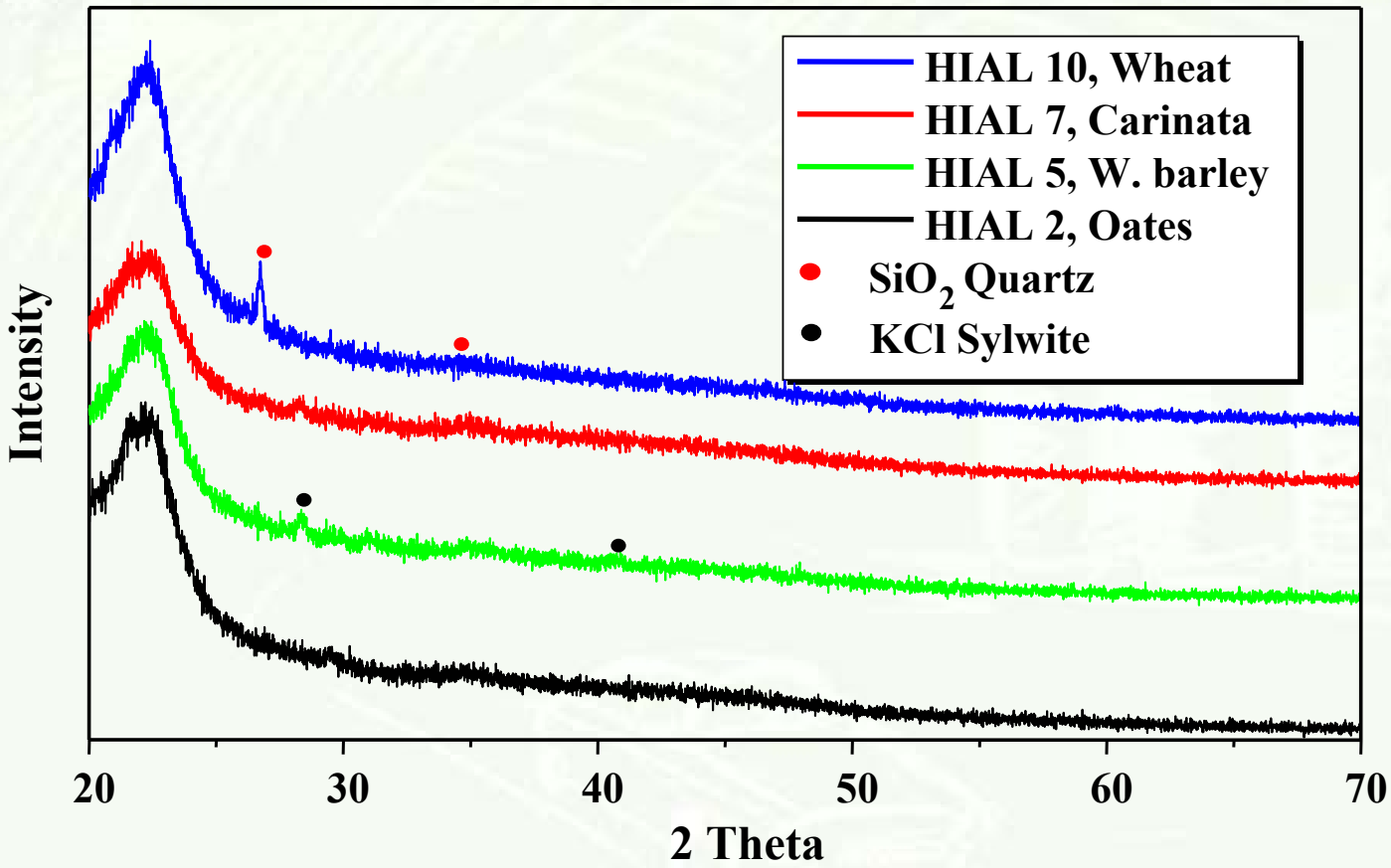
SO_2 Release at 800 °C and S Concentration in different Samples

(Res. Centre Jülich)



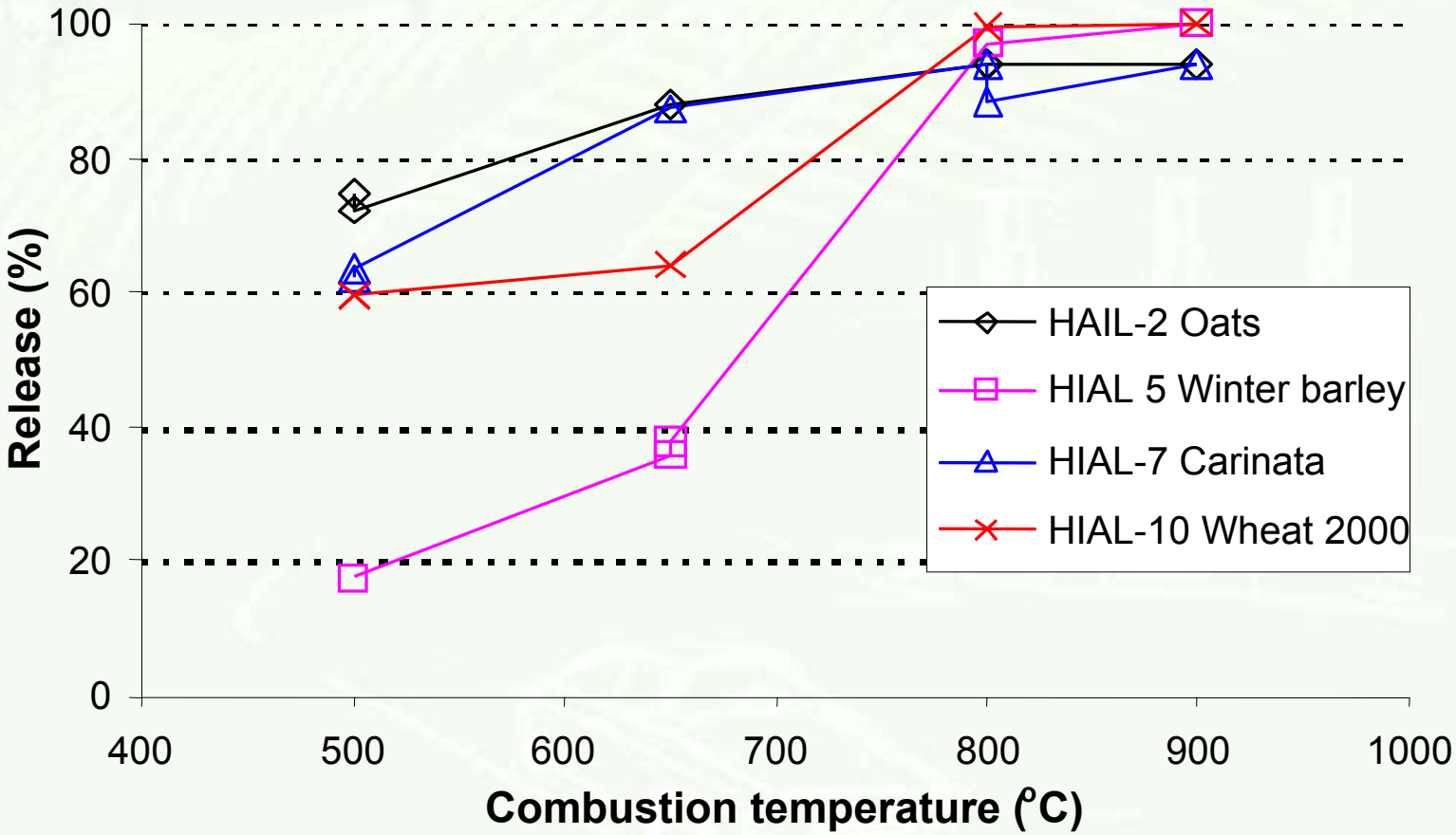
XRD of Biomass Samples

(Res. Center Jülich)



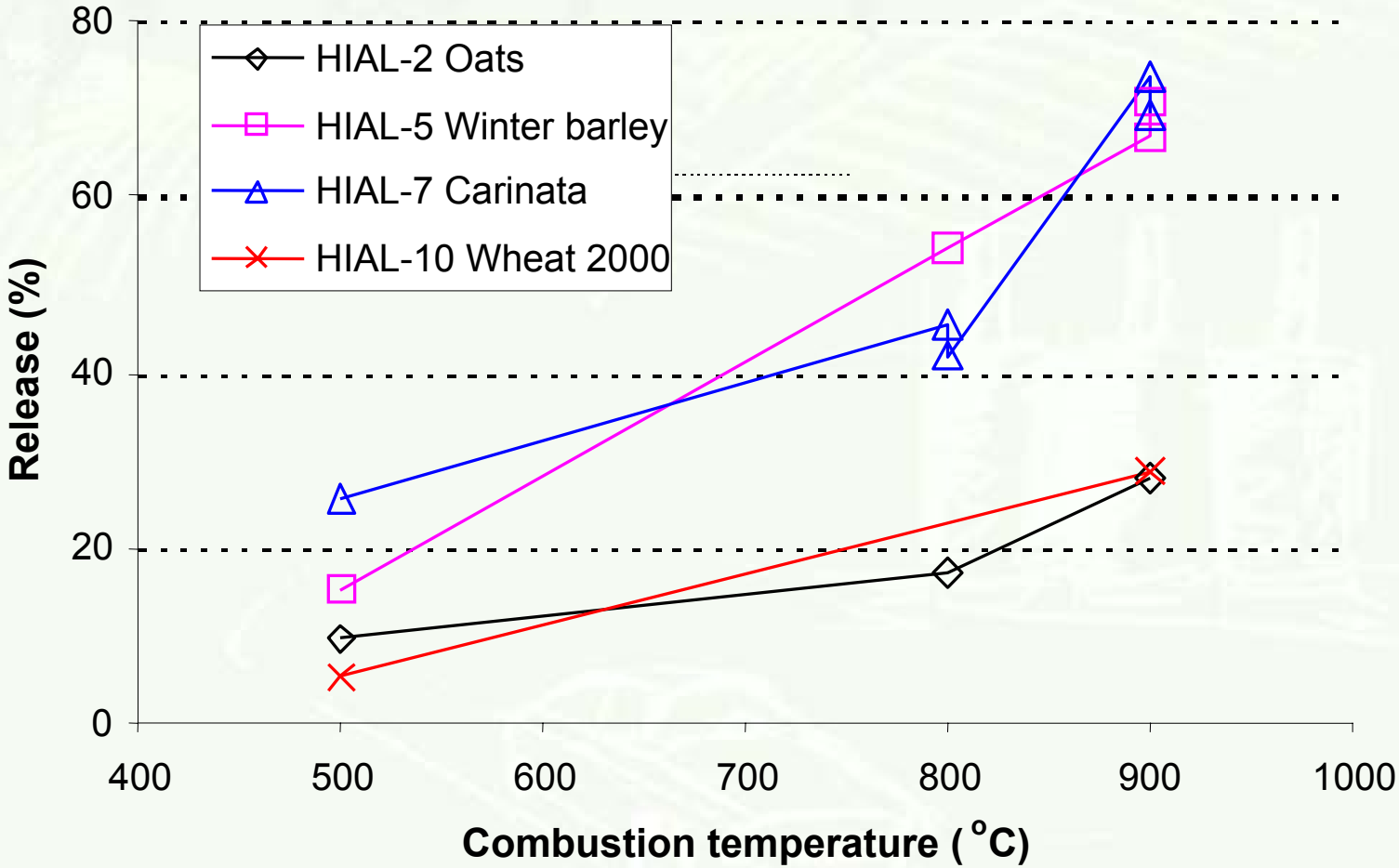
Chlorine Release During Combustion

(Danish Technical University)



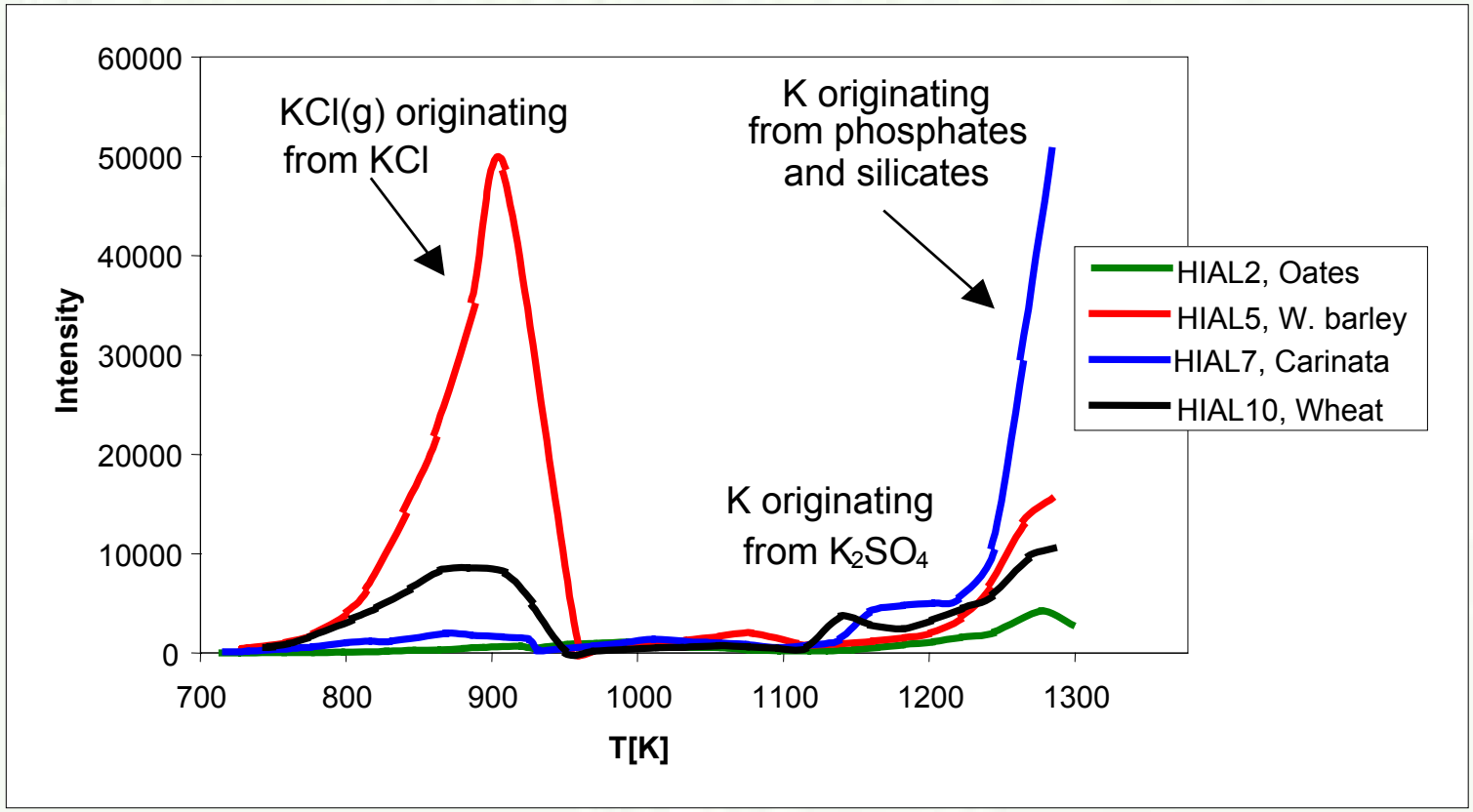
Potassium Release During Combustion

(Danish Technical University)



MS Vaporisation Measurements of Biomass/Coal (1:1) Ashes (550 °C)

(Res. Center Jülich)



Results on the Release of Sulphur, Potassium and Chlorine

Sulphur

- High amounts of Potassium lower the SO_2 release by formation of Potassium sulphates
- Silica promotes the release of SO_2 by potassium capture inhibiting the K_2SO_4 formation

Potassium

- Release of Potassium rather dependents on Chlorine content then Potassium content of the samples
- High silica content reduces Potassium release

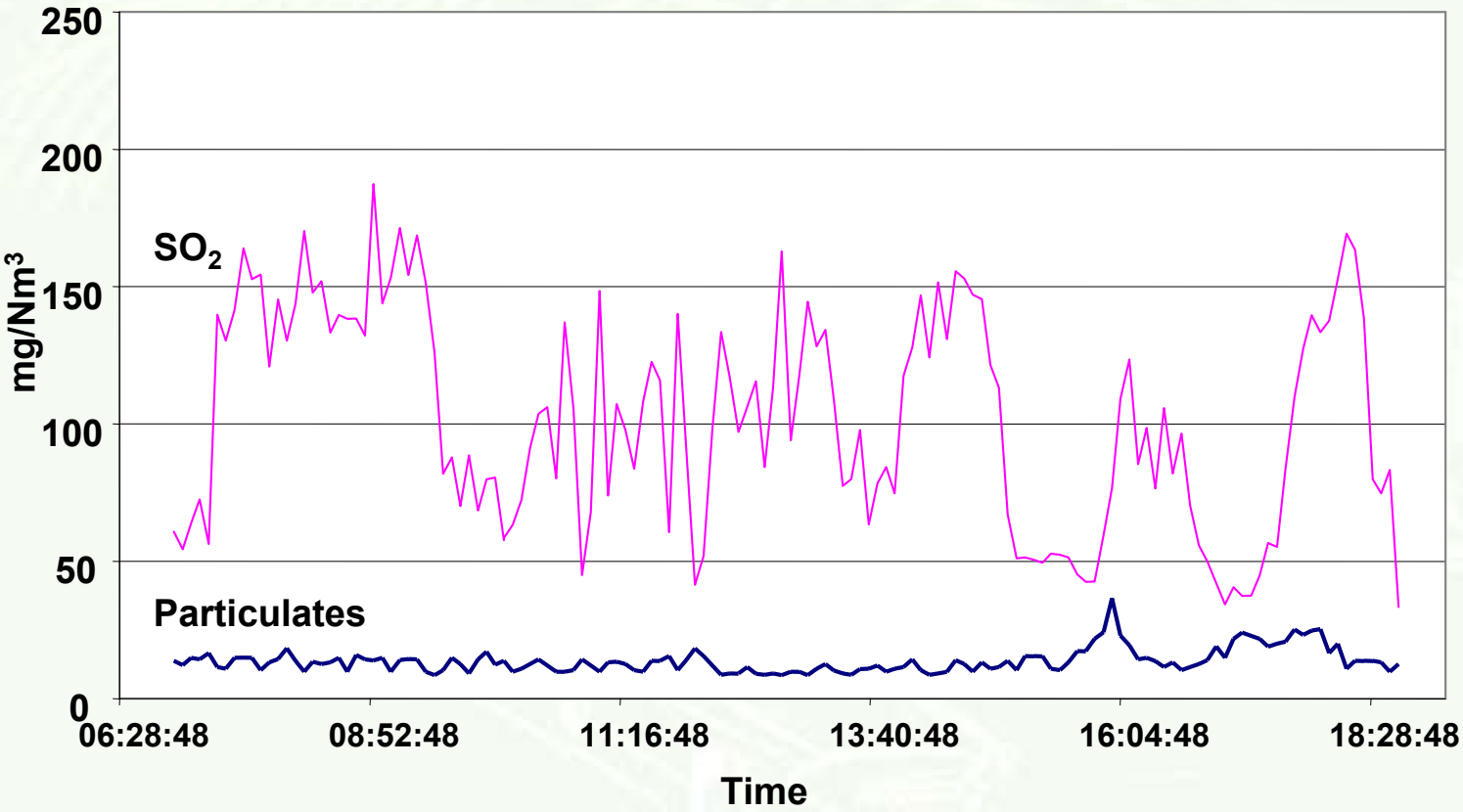
Chlorine

- Chlorine is completely released at $T \geq 800$ °C

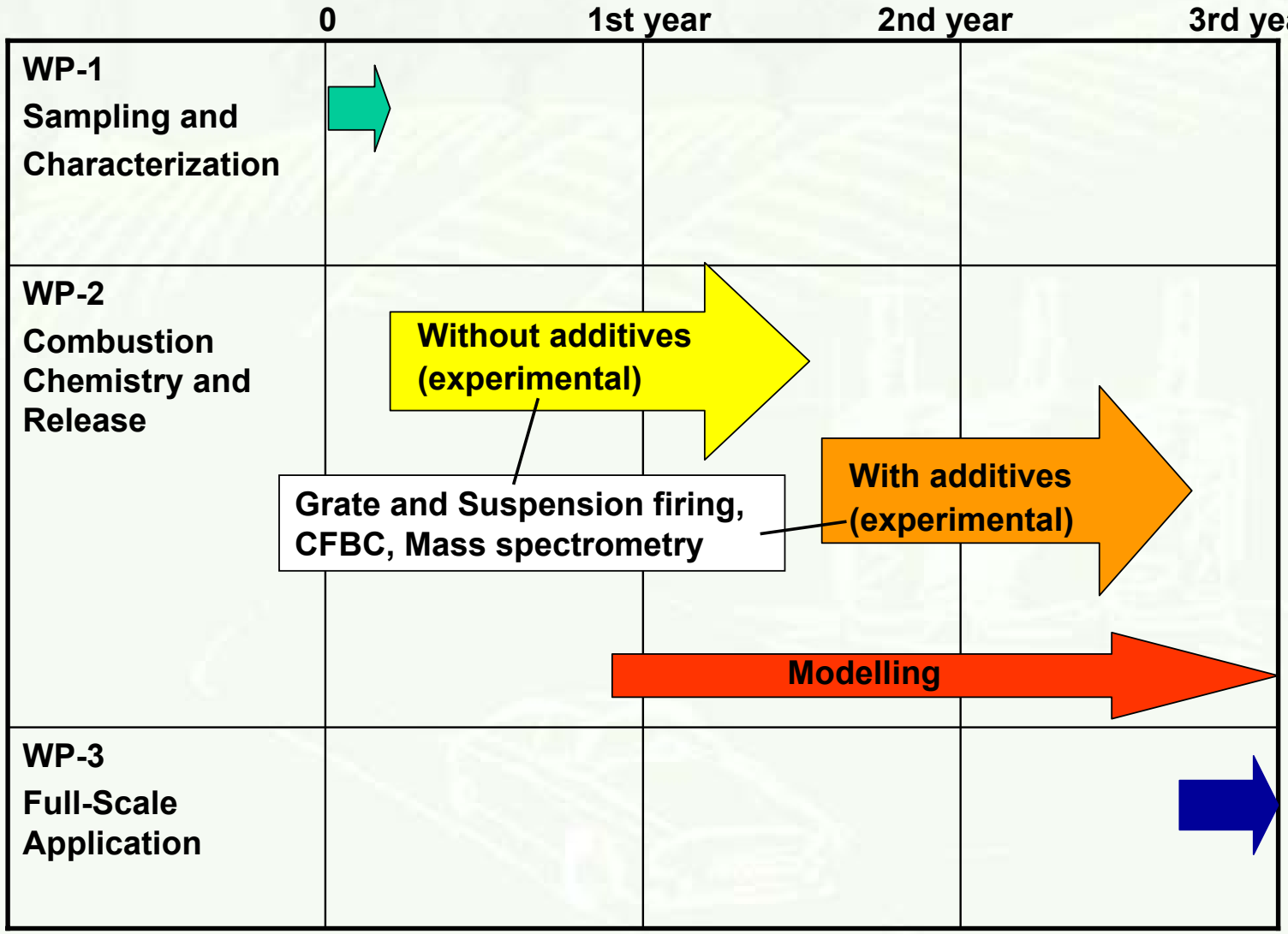
Sulphur Release at Ensted Power Plant

(TechWise)

Barley straw, 08.10.2002, 7:00-18:45



Timetable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