Effect of number concentration of soot and H_2SO_4 on aerosol based emissions from a post combustion capture plant

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Contents

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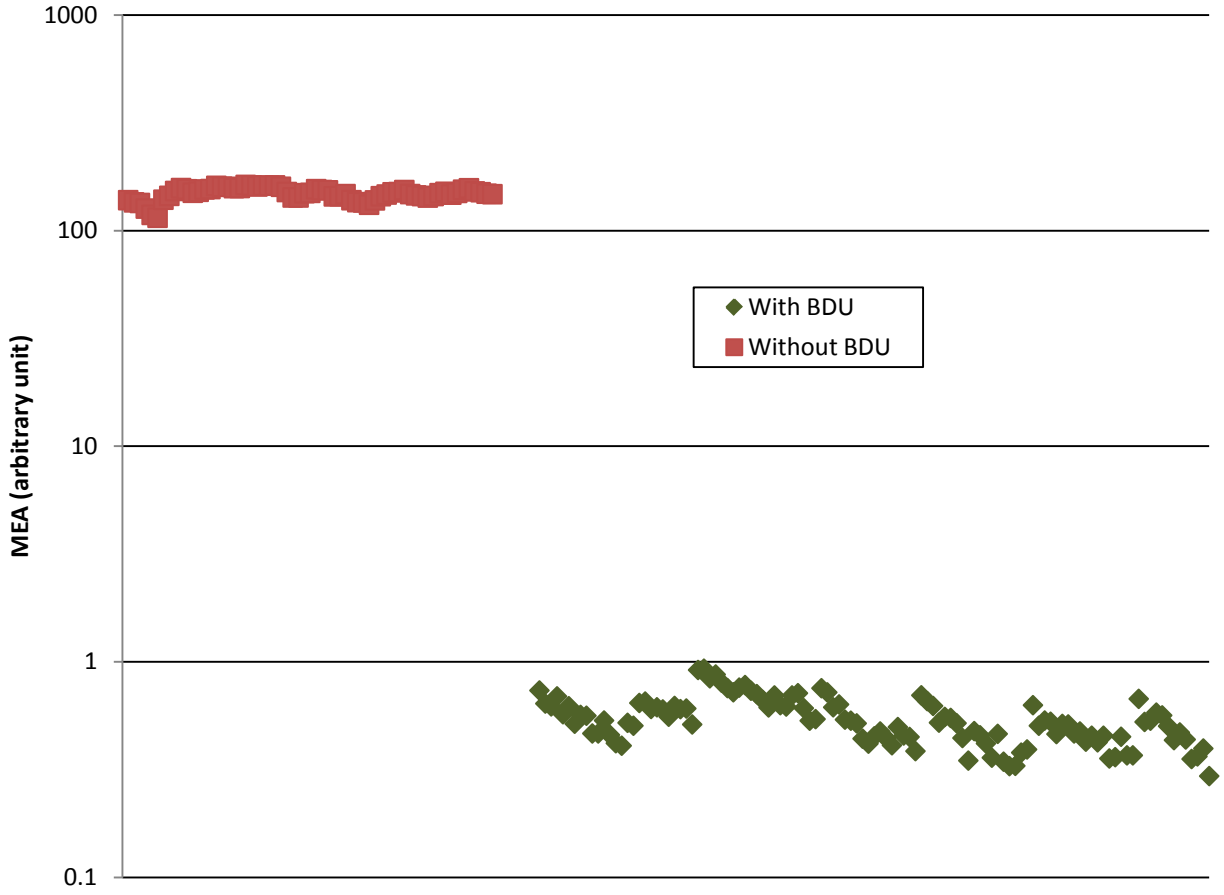
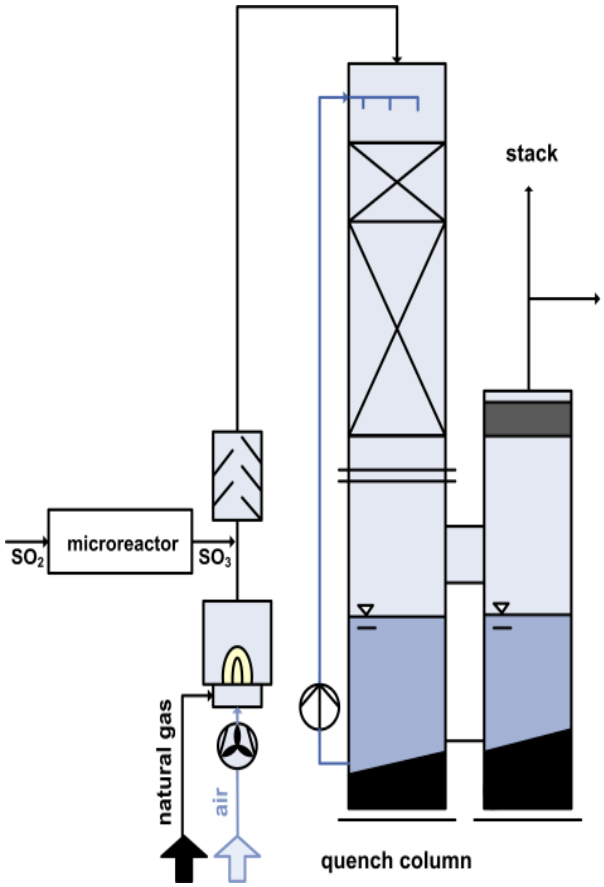
Background

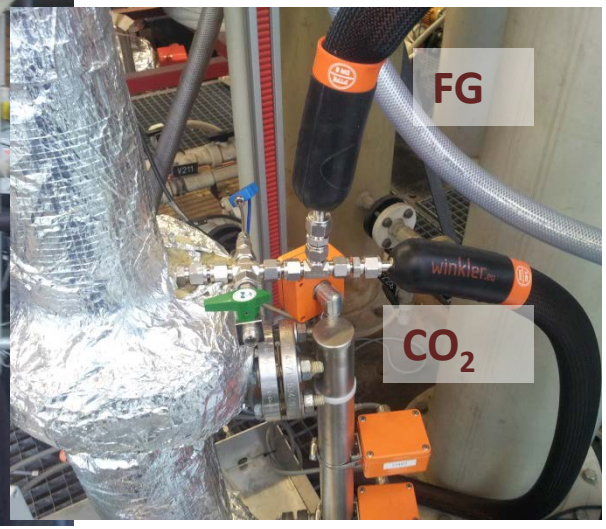
- Special Demisters work (e.g. Brownian Demister Unit*)



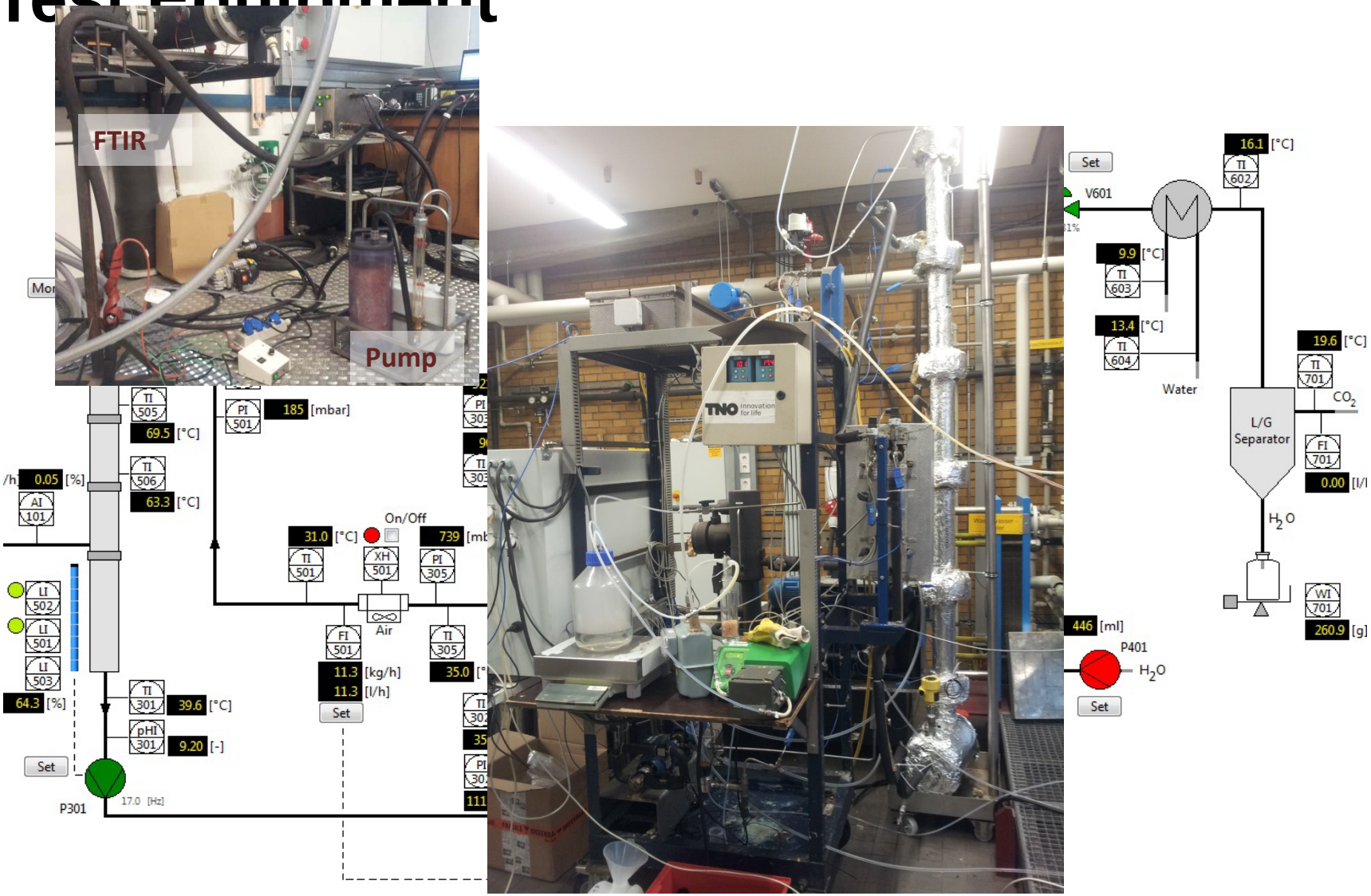
* WP1 and 3: CCM TQP amine 6- Emission Quantification and Reduction

Test Equipment



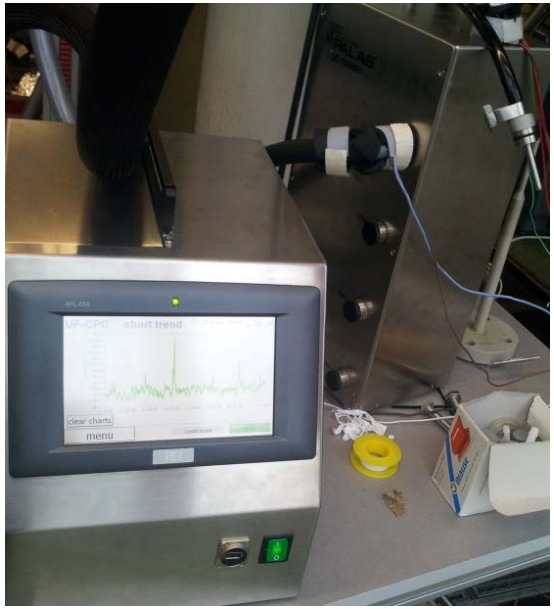


Test Equipment

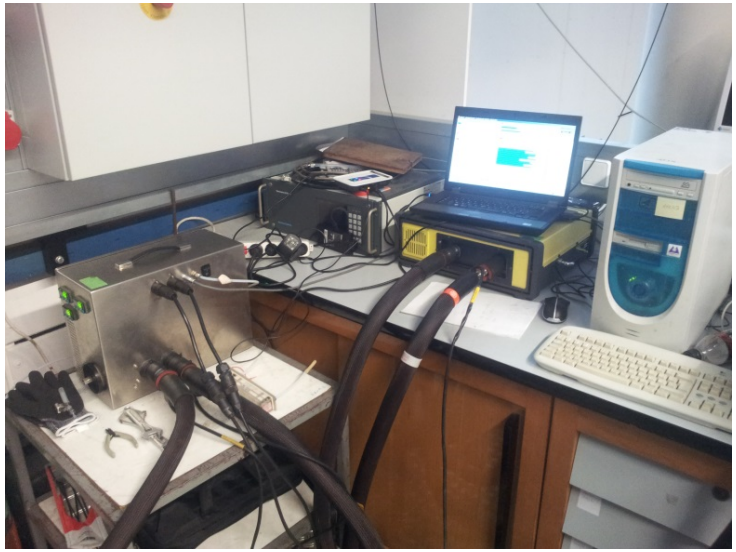


Test Equipment

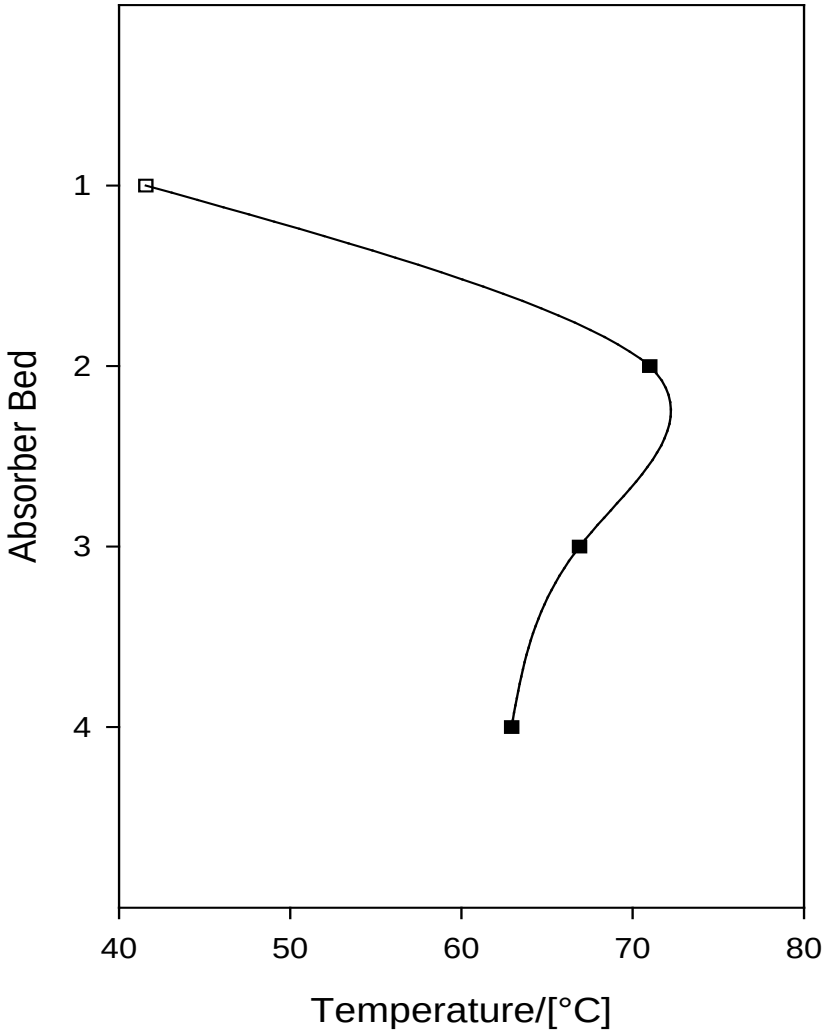
CPC



FTIR

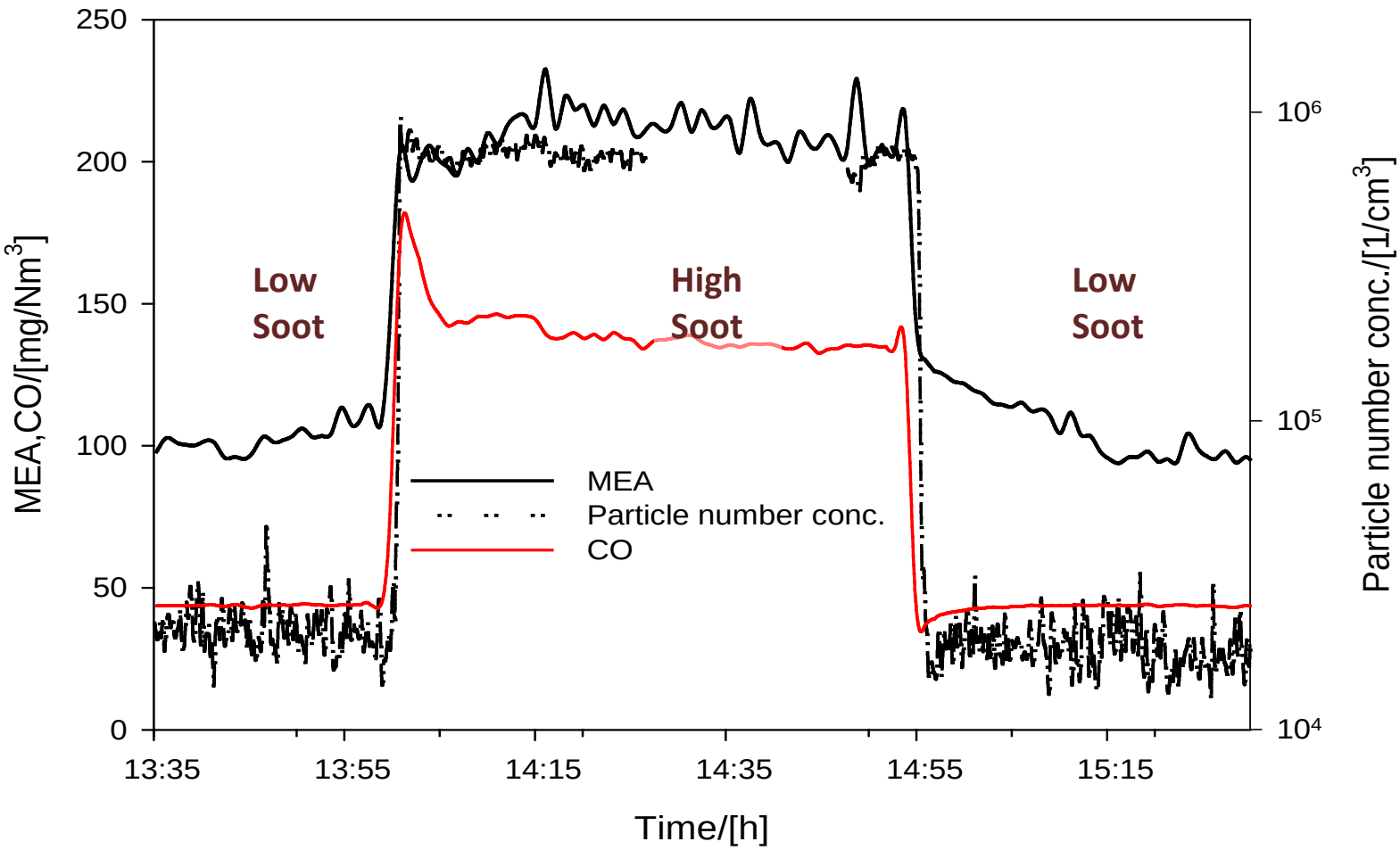


Temperature profile



Results

Ef



Air +12 % CO_2 → MEA ~40-50 mg/Nm^3

Results

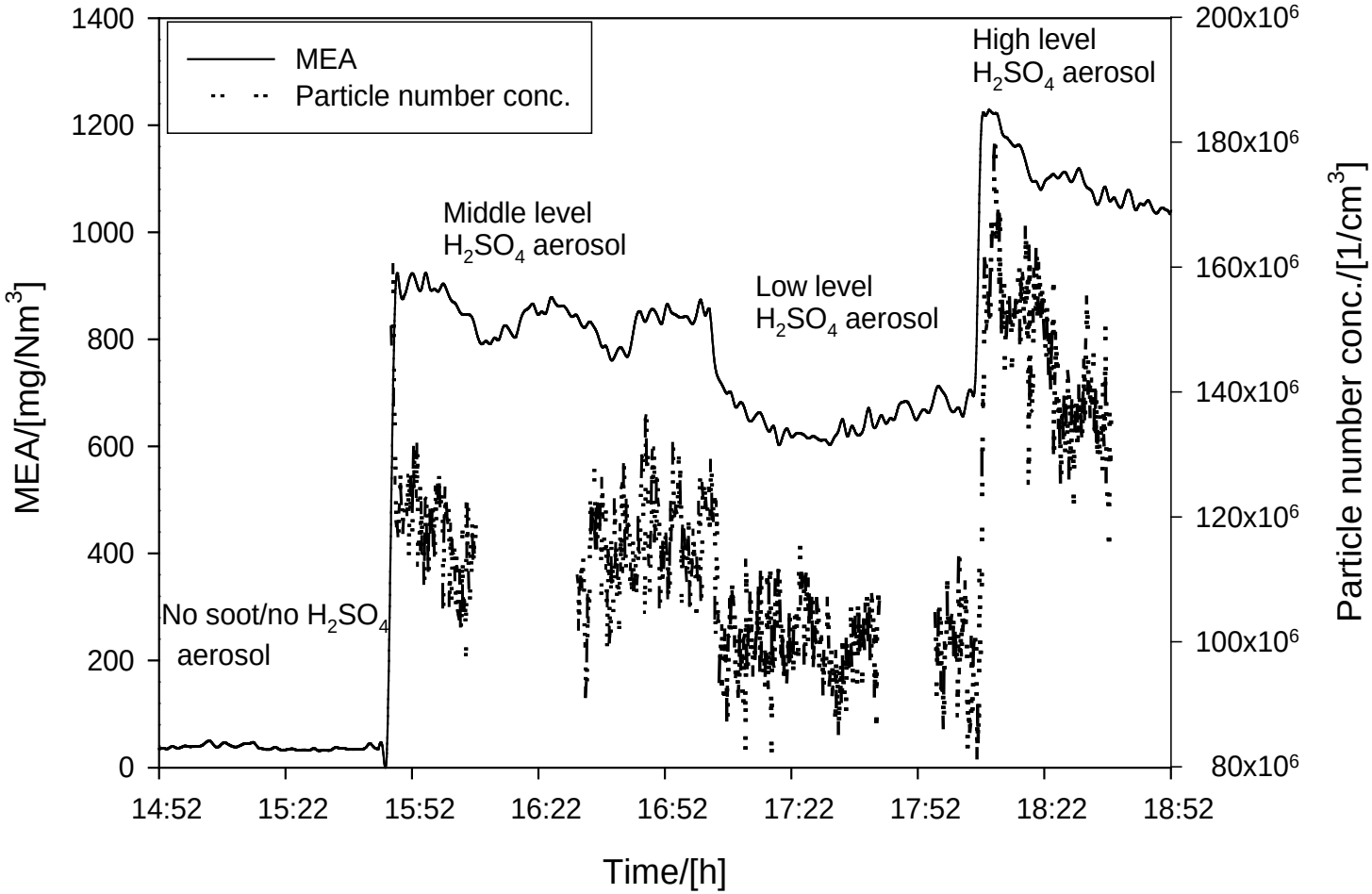
Effect of H_2SO_4 nuclei

Levels	Average particle number conc. ($1/cm^3$)
Low	$1.02*10^8$
Middle	$1.18*10^8$
High	$1.42*10^8$

-Mass concentration in the range of 1-5 mg/Nm^3
- Size below 100 nm

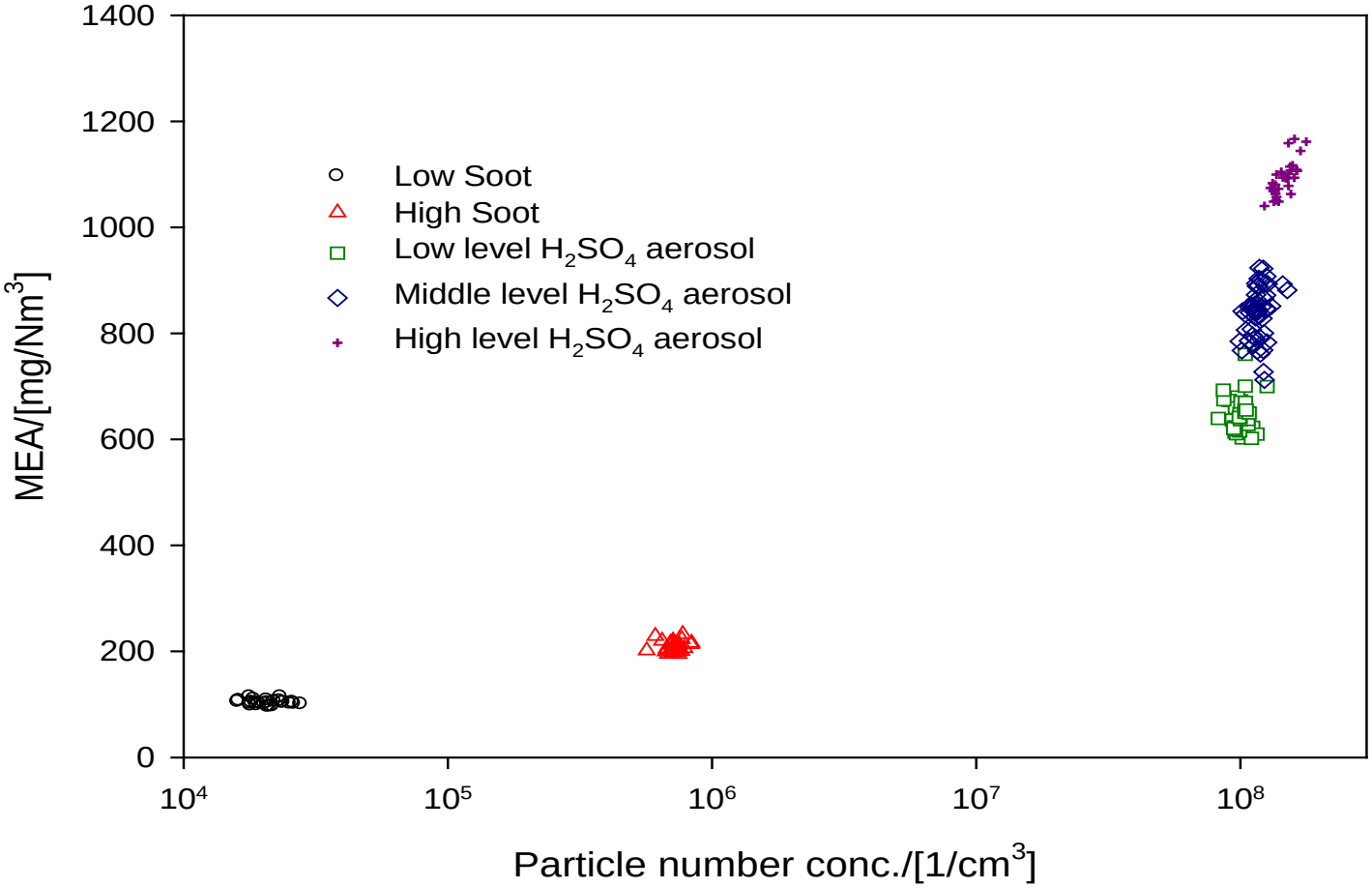
Results

Effect of H_2SO_4 nuclei



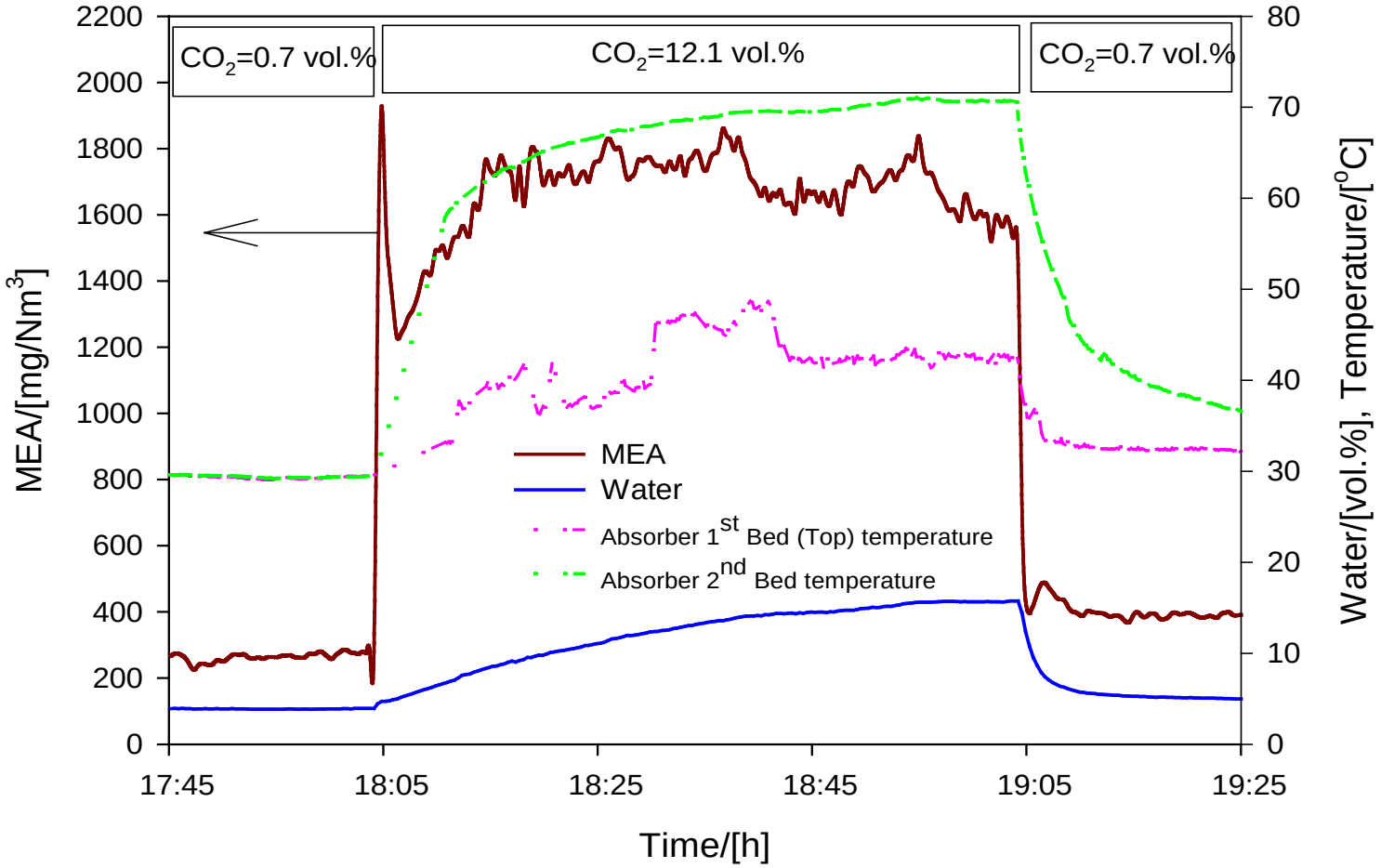
Results

Relation of number concentration to emissions



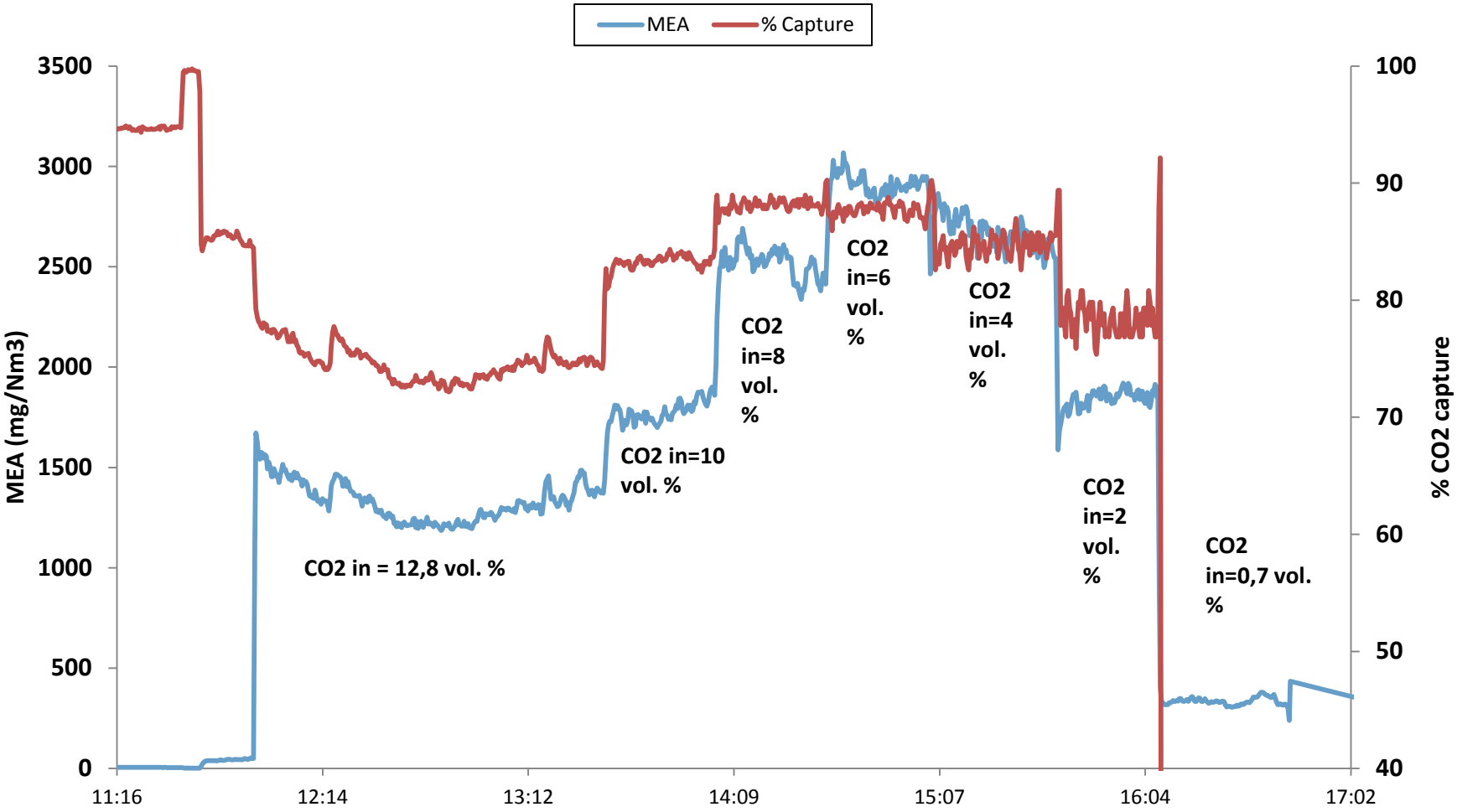
Results

Effect of capture plant parameters on emissions



Results

Effect of capture plant parameters on emissions



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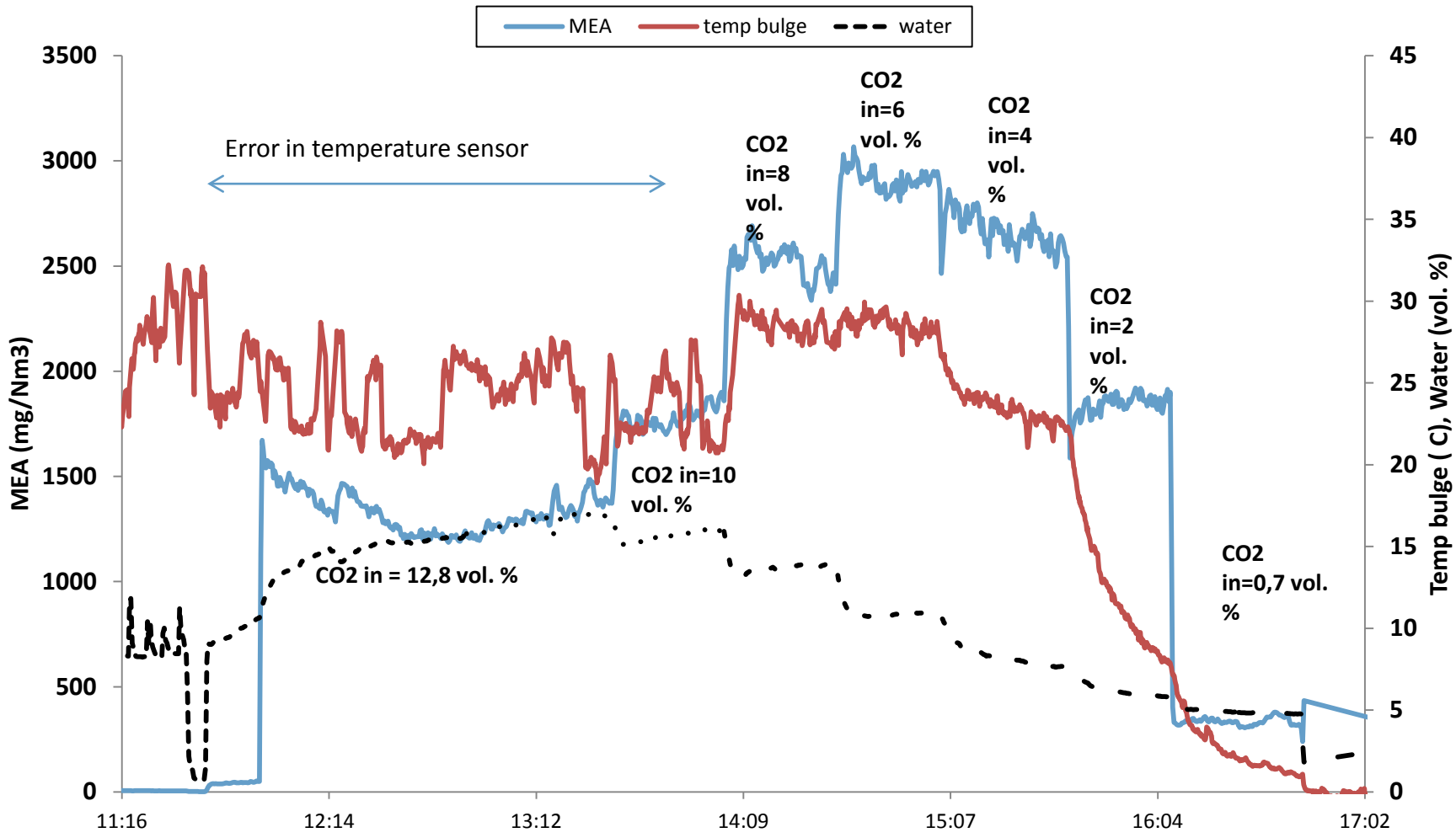
Results

Effect of capture plant parameters on emissions



Other observations

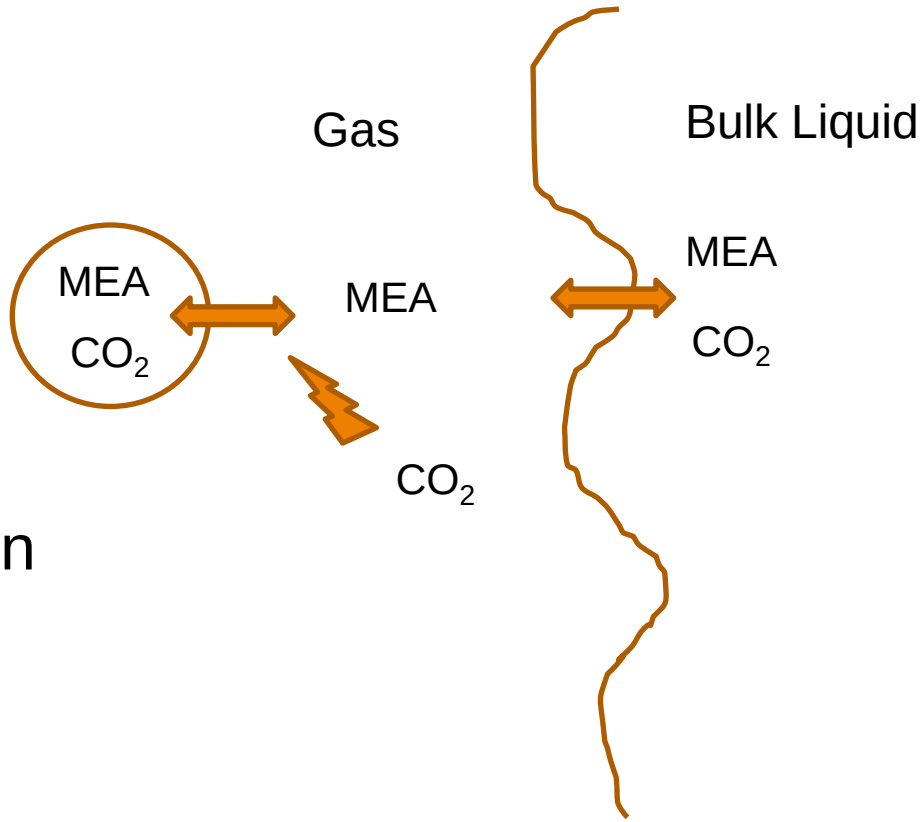
- No effect on ammonia emissions
- Similar observations for AMP-Piperazine as capture solvent.

Mechanism

- Supersaturation

$$S = \frac{\sum p_i(T, y_i)}{\sum p_i^e(T, y_i)}$$

- Heterogeneous nucleation
- Temperature bulge
- Role of CO_2
- Nature of nuclei



Conclusions

- Clear impact of particles in flue gas on solvent emissions
- Soot particles in the order of 10^6 per cm^3 leads to MEA emissions of 200 mg/Nm^3
- H_2SO_4 nuclei in the order of 10^8 per cm3 leads to MEA emissions of 600-1100 mg/Nm^3
- Capture plant operating parameters have an impact on the extent of emissions
- Design of suitable counter-measures necessary

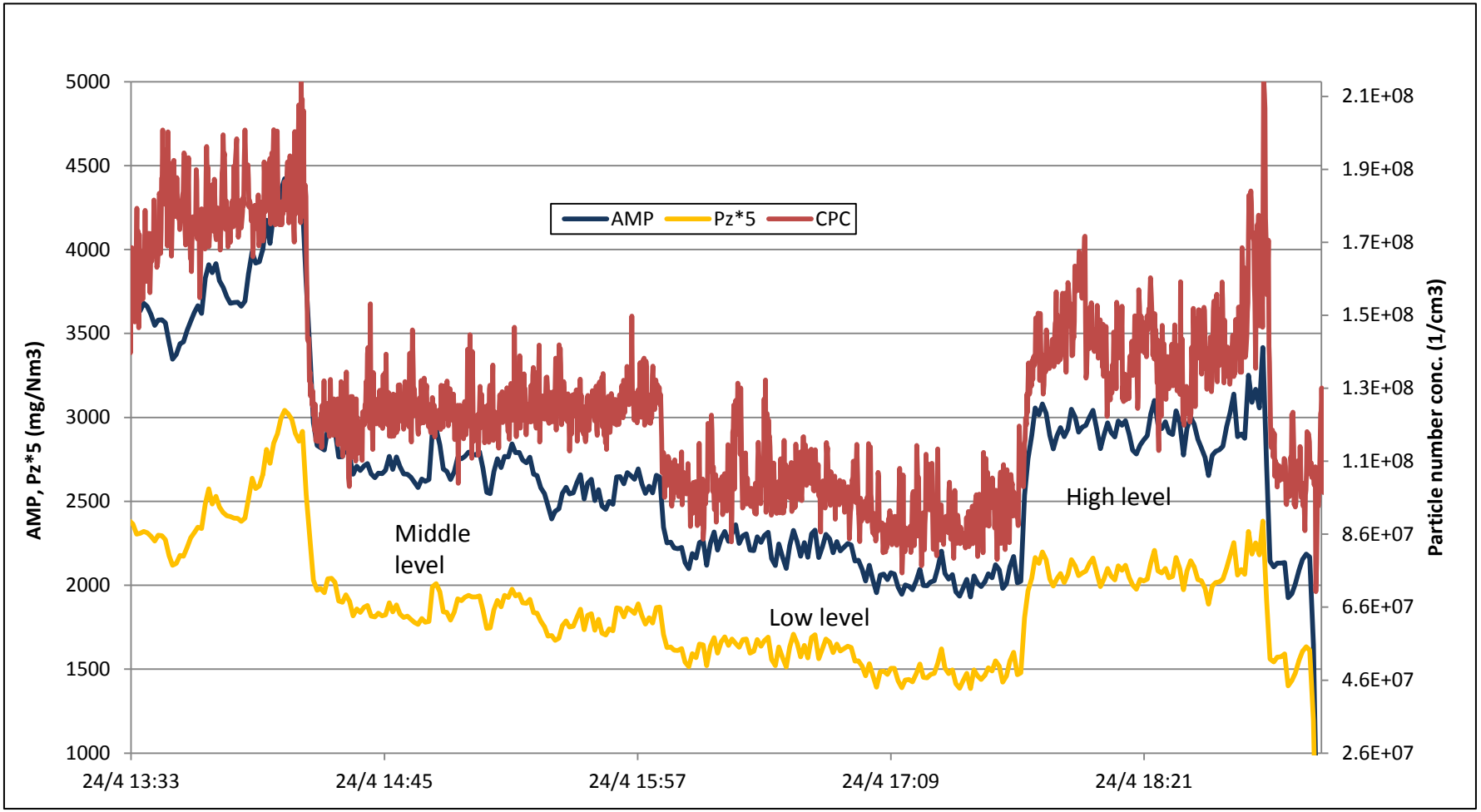
Acknowledgements

- This work has been sponsored by the CATO-2 program (*http://www.co2-cato.org*)

- Thanks to KIT and staff.

- Continuous support from Laborelec/GDF-Suez and E.ON

AMP-Pz


AMP
Pz*5
CPC
AMP, Pz*5 (mg/Nm3)
Particle number conc. (1/cm3)
5000
4500
4000
3500
3000
2500
2000
1500
1000
2.1E+08
1.9E+08
1.7E+08
1.5E+08
1.3E+08
1.1E+08
8.6E+07
6.6E+07
4.6E+07
2.6E+07
24/4 13:33
24/4 14:45
24/4 15:57
24/4 17:09
24/4 18:21
Middle level
Low level
High level