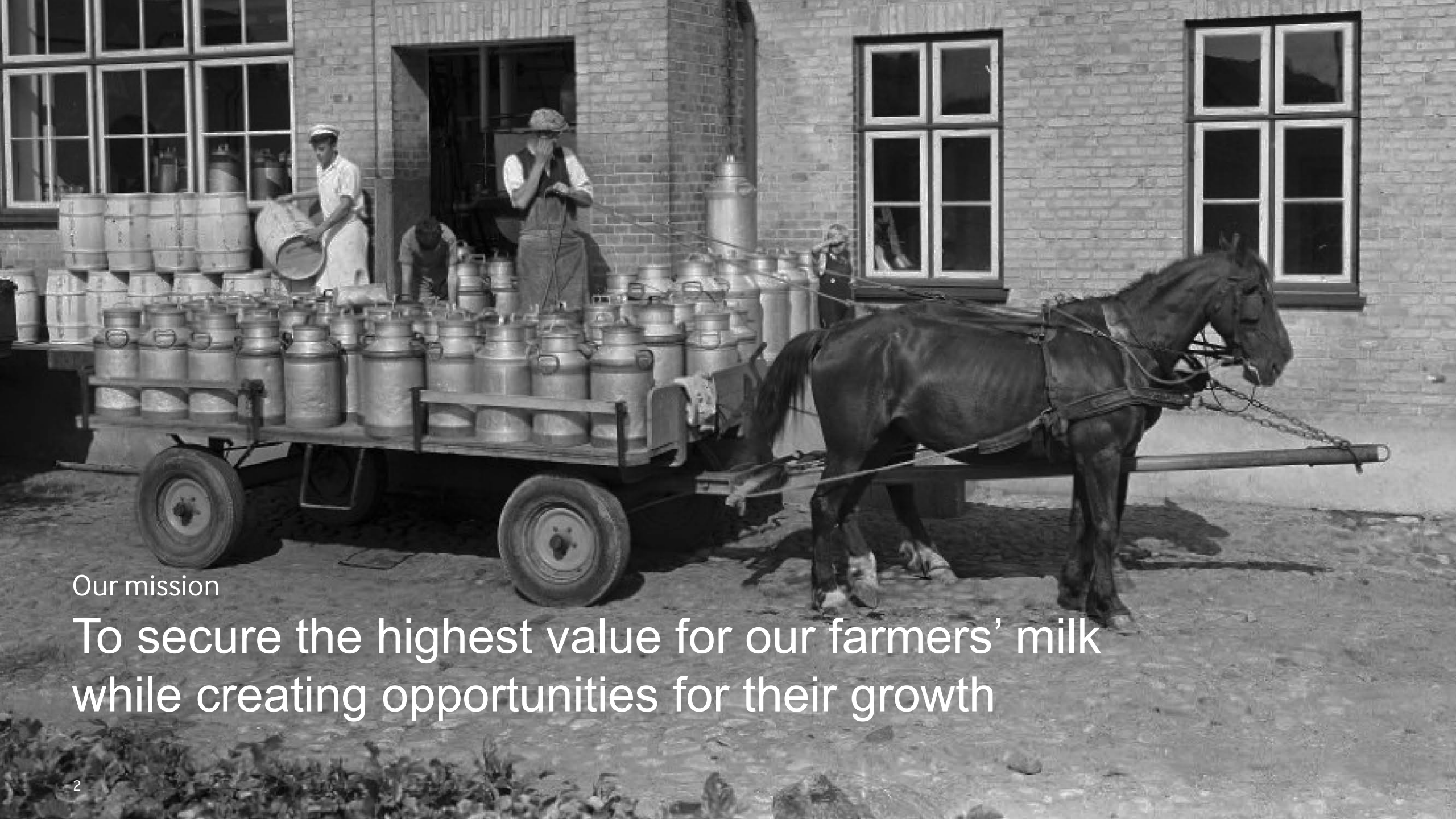
Using isotherms for understanding shelf life of milk powder

Research Scientist, Mikka Stenholdt Hansen



Our mission

To secure the highest value for our farmers' milk while creating opportunities for their growth

About Arla

12,000 OWNERS

14 BL. KG. MILK INTAKE

THE 4TH LARGEST

19,000 COLLEAGUES

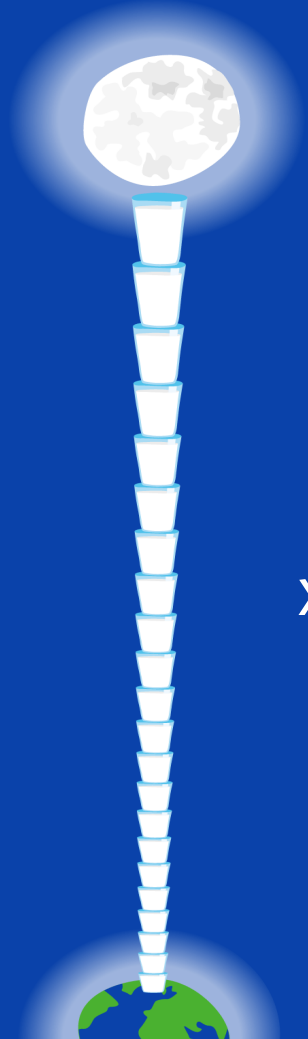
Arla
LURPAK
CASTELLO
3 BRANDS

9,6 BL. EURO REVENUE

We have grown to become the **4th largest dairy** company in the world

3.5 glasses for everyone

To the moon



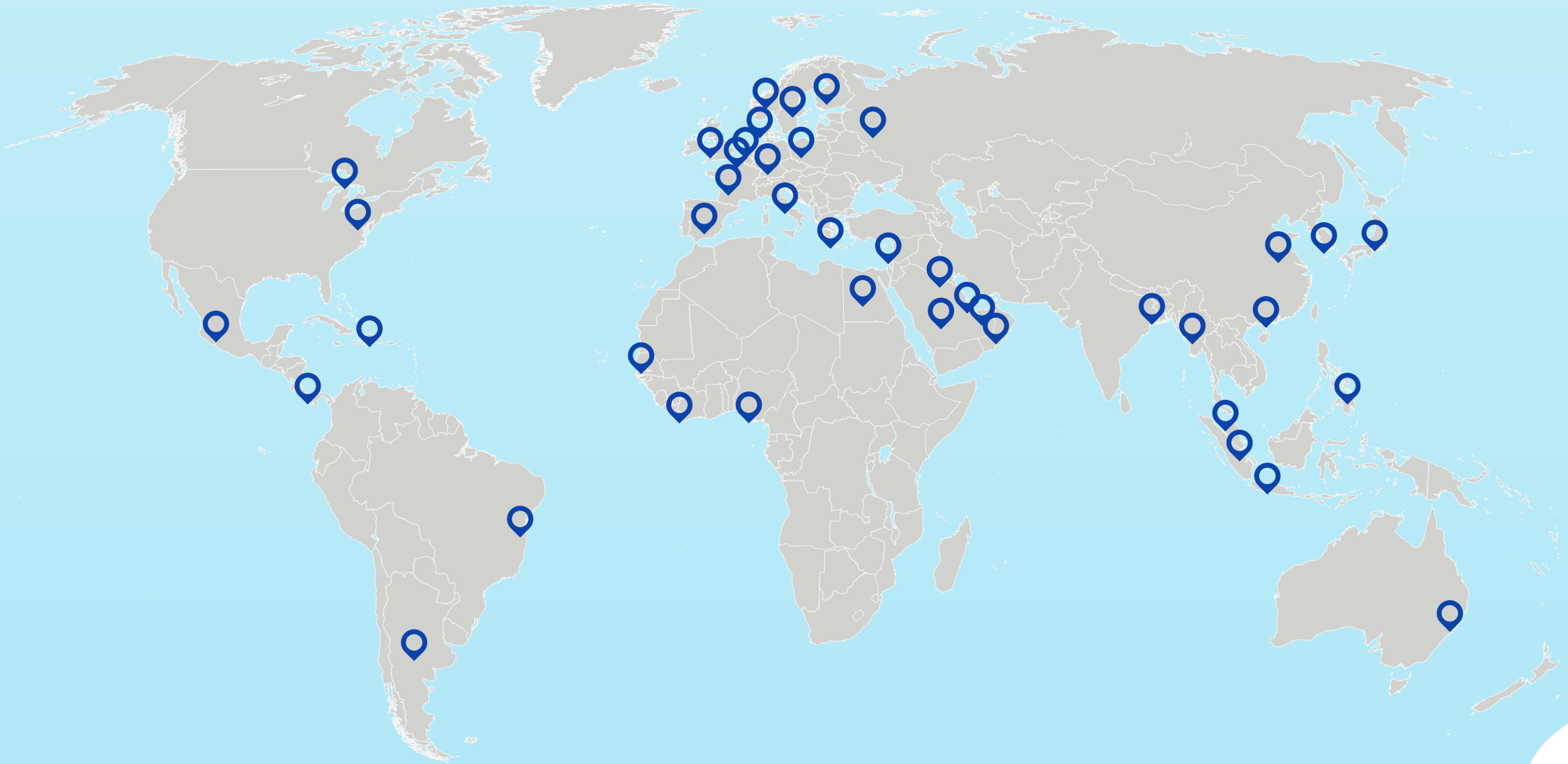
x 7

Around the world

x 47

Approximatly **15%** of the milk is turn in to powder

Arla in the **world**



Challenges

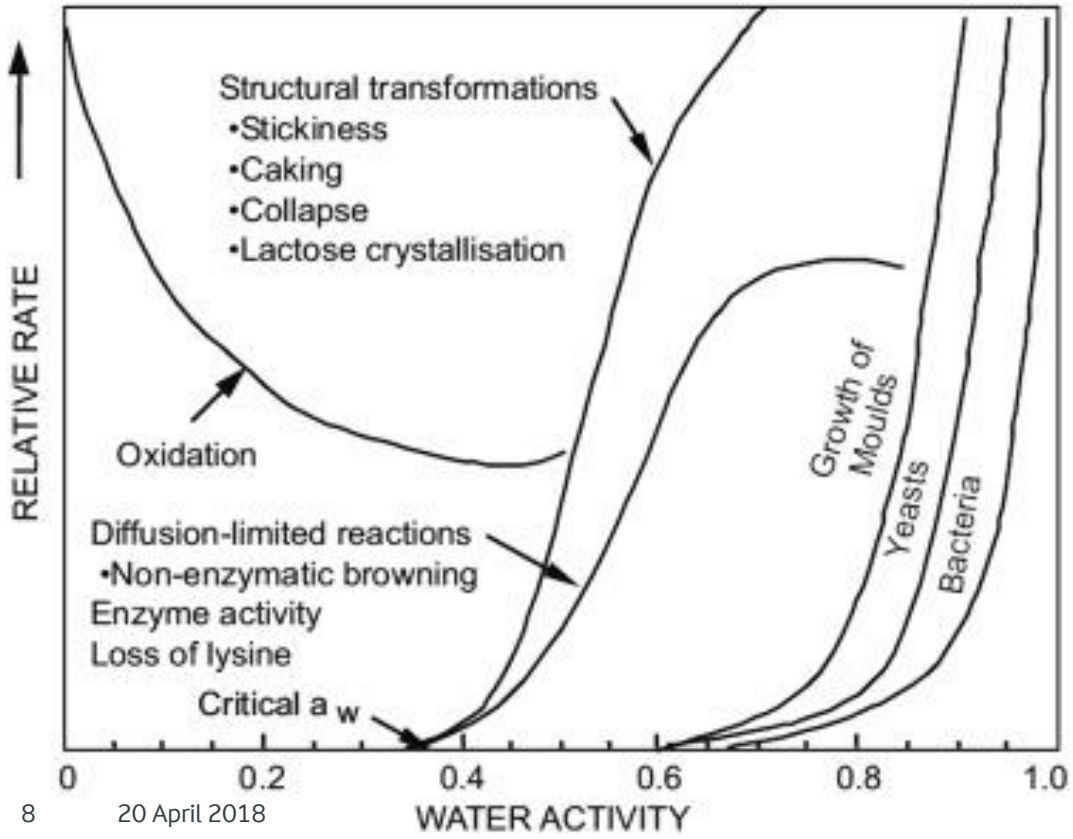
Powder caking

Powder browning

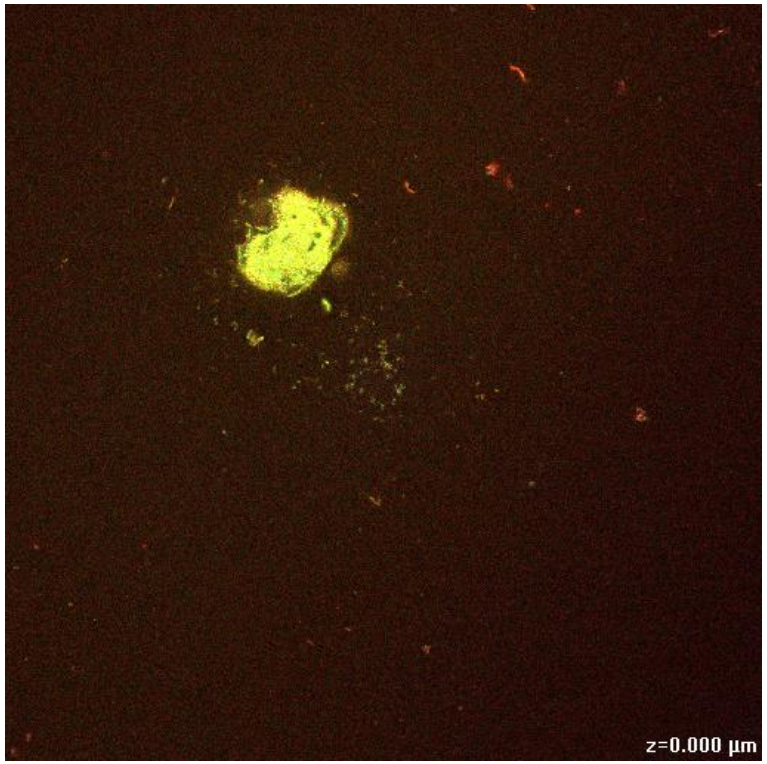
Powder caking

Strategies for Structured Particulate Systems

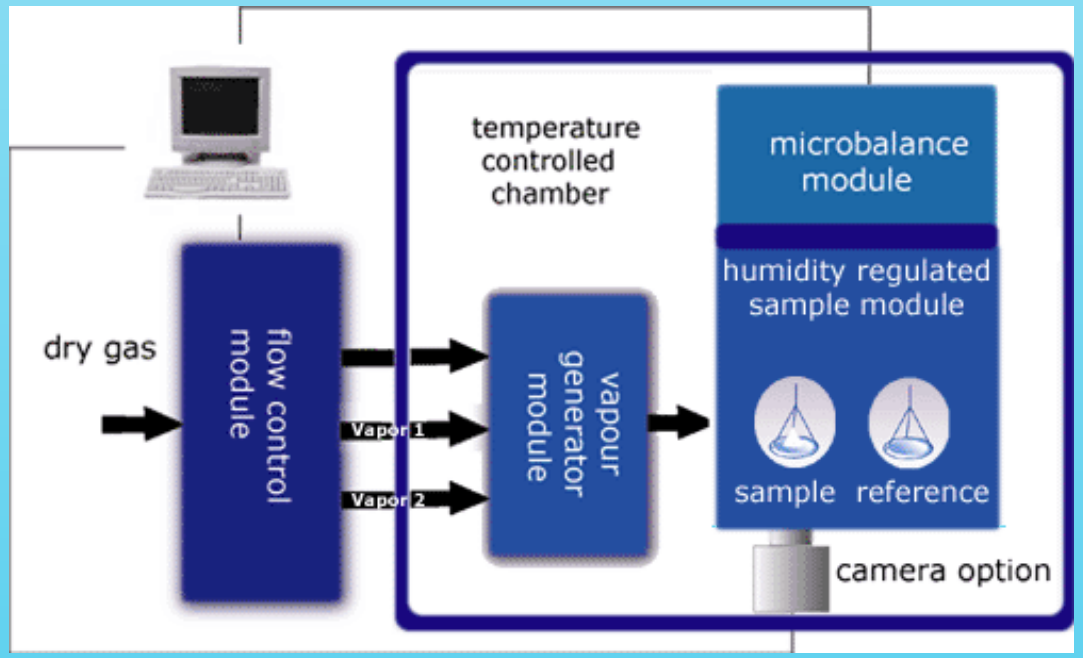
Amorphous lactose can hold more water than crystalline lactose.

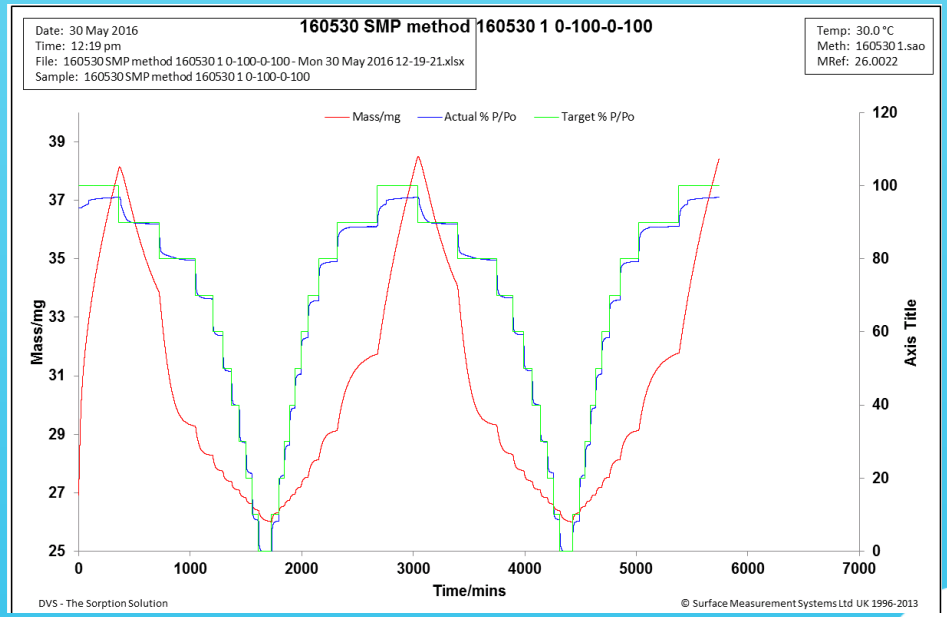


CLCM
Reflection




DVS
ELEVATED
TEMPERATURE


temperature
controlled
chamber
microbalance
module
humidity regulated
sample module
dry gas
flow control
module
Vapor 1
Vapor 2
vapour
generator
module
sample
reference
camera option

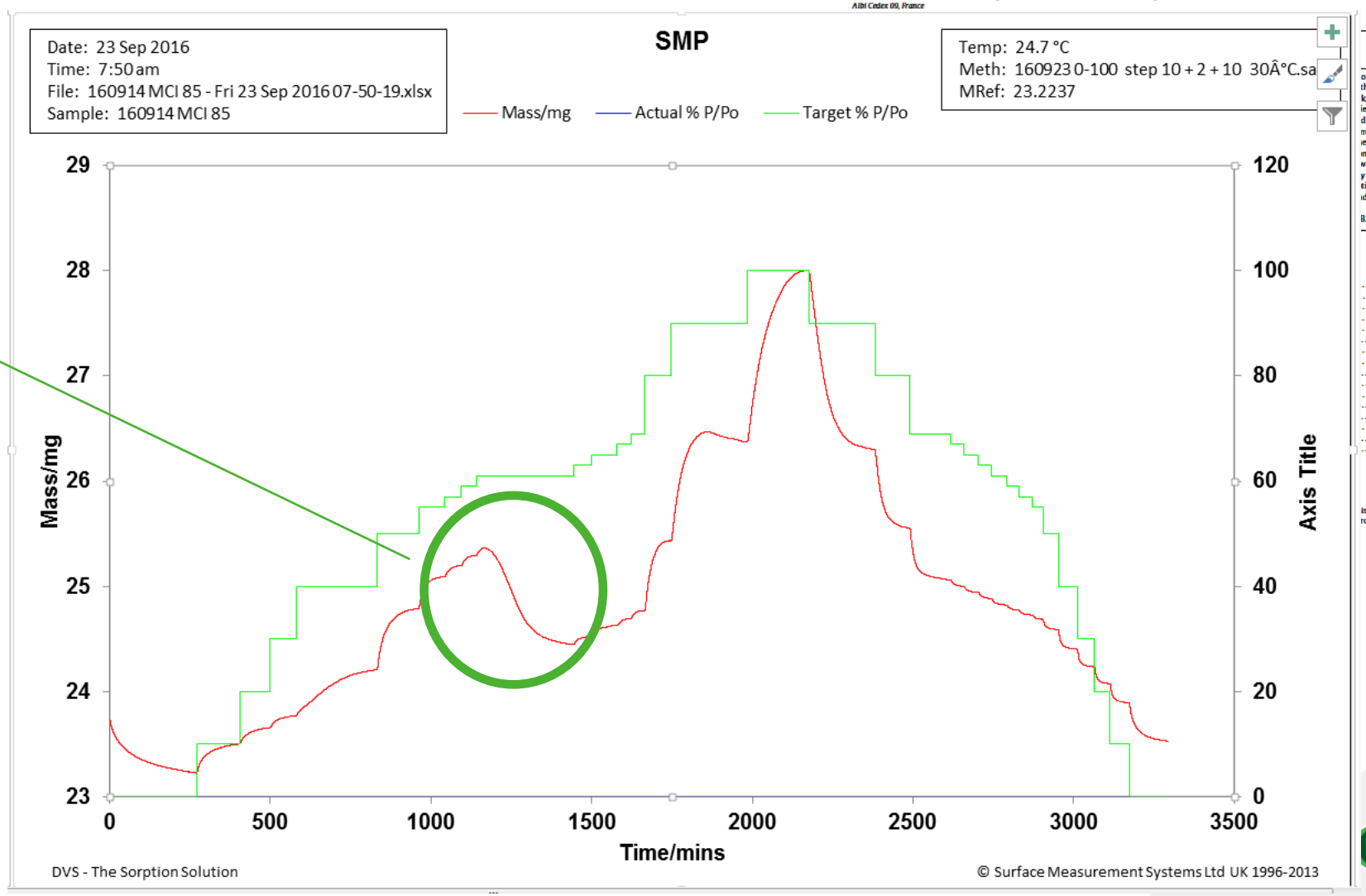

160530 SMP method 160530 1 0-100-0-100
Date: 30 May 2016
Time: 12:19 pm
File: 160530 SMP method 160530 1 0-100-0-100 - Mon 30 May 2016 12-19-21.xlsx
Sample: 160530 SMP method 160530 1 0-100-0-100
Temp: 30.0 °C
Meth: 160530 1.sao
MRef: 26.0022
Mass/mg
Actual % P/Po
Target % P/Po
Mass/mg
Axis Title
Time/mins
DVS - The Sorption Solution
© Surface Measurement Systems Ltd UK 1996-2013

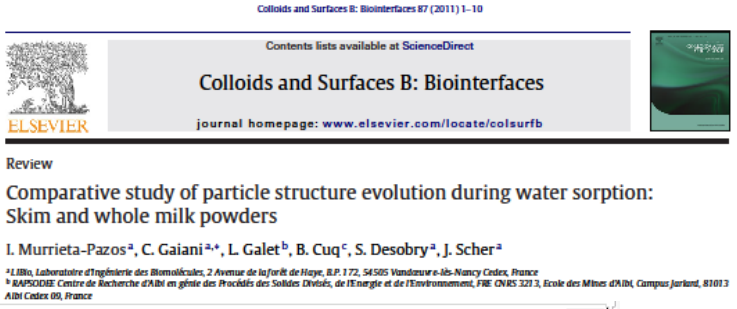
Skim Milk Powder

30°C, 0-98 P/P_0, 2 cycles, step size 10

At 30°C, 60 P/P_0 amorphous lactose transform to crystalline lactose.

Amorphous lactose can hold more water than crystalline lactose, therefore a drop in mass is seen.

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Review

Comparative study of particle structure evolution during water sorption: Skim and whole milk powders

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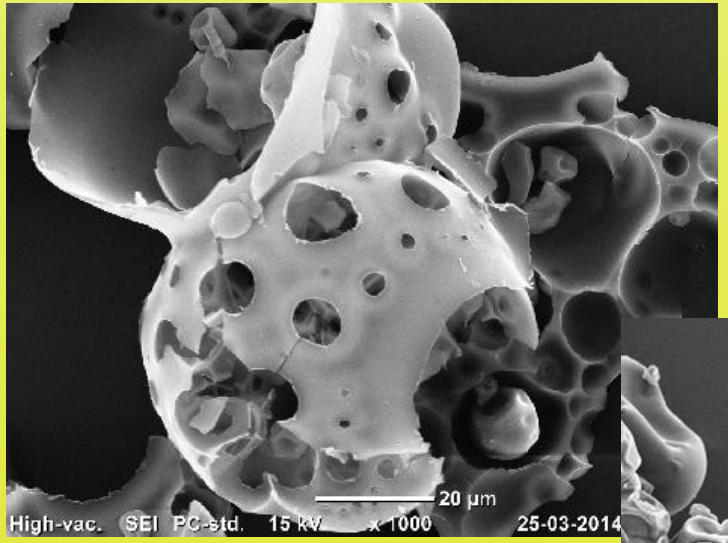
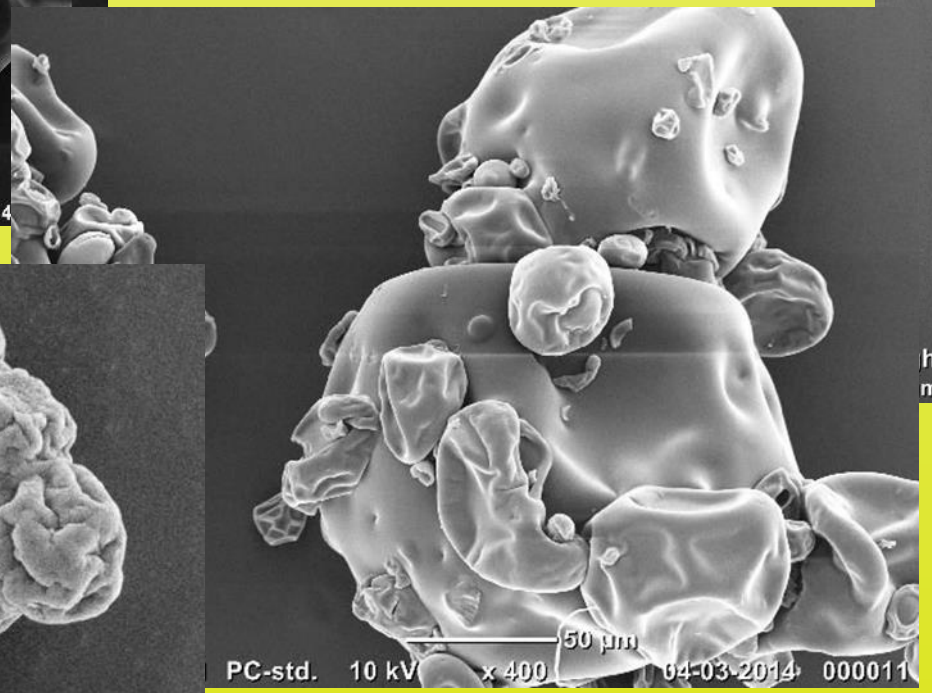
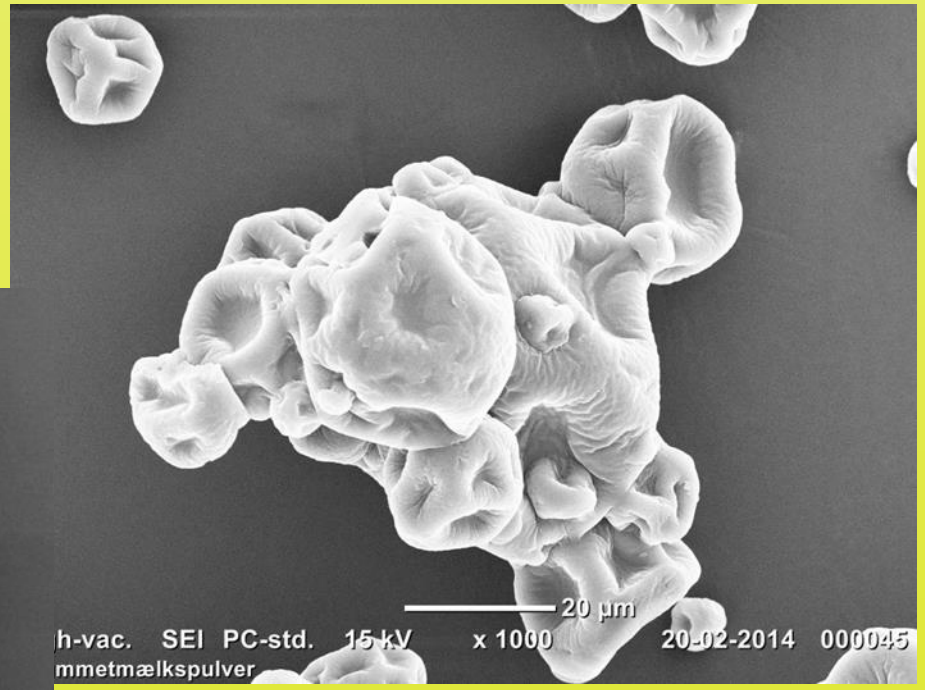
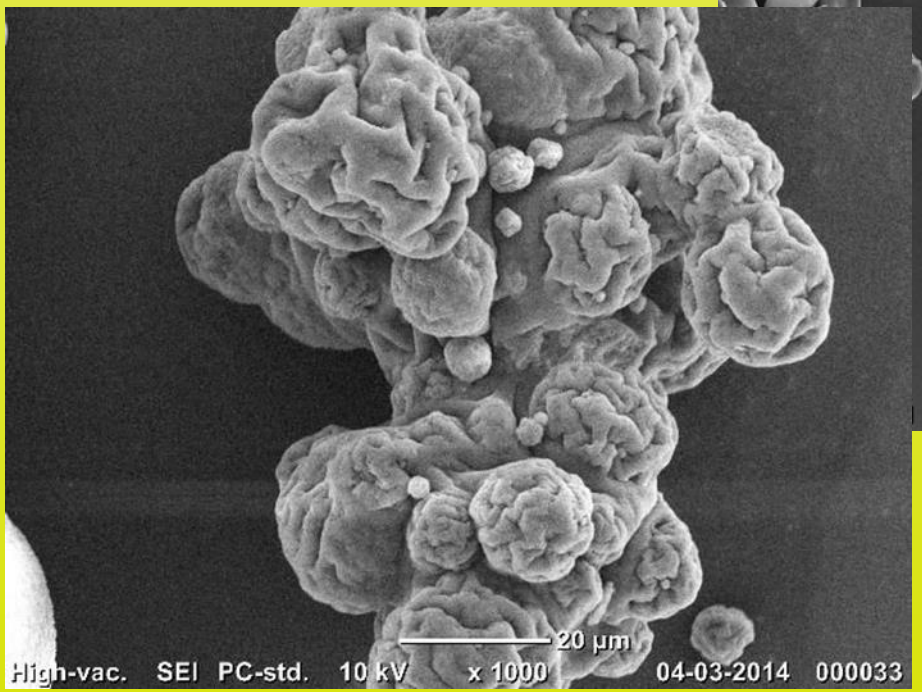
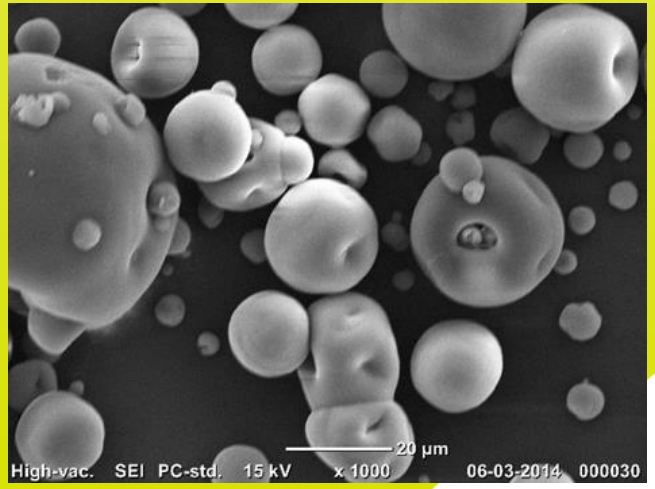

20 µm
High-vac. SEI PC-std. 15 kV x 1000 25-03-2014


50 µm
PC-std. 10 kV x 400 04-03-2014 000011

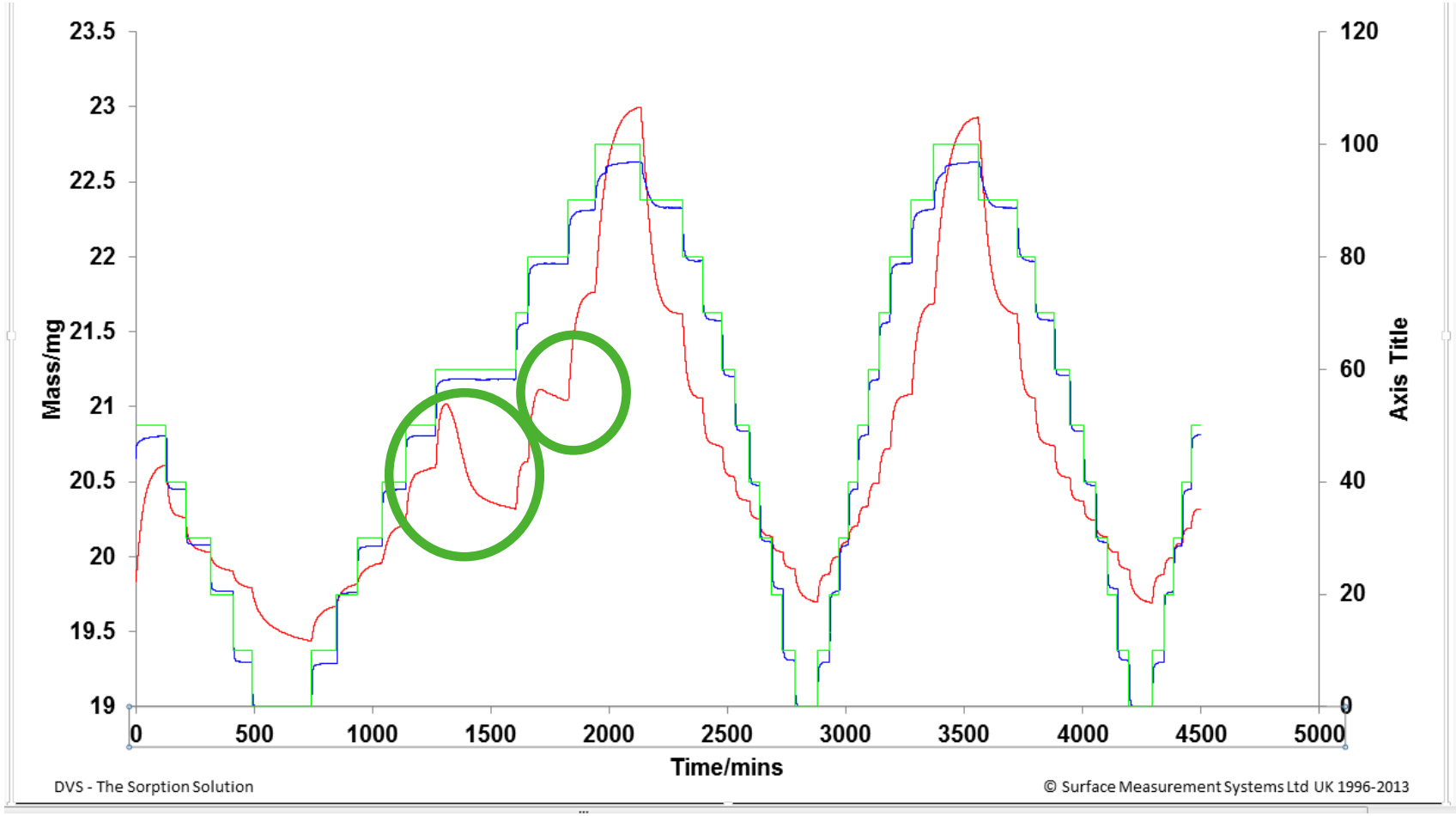

20 µm
h-vac. SEI PC-std. 15 kV x 1000 20-02-2014 000045
mmetmælkspulver


20 µm
High-vac. SEI PC-std. 10 kV x 1000 04-03-2014 000033

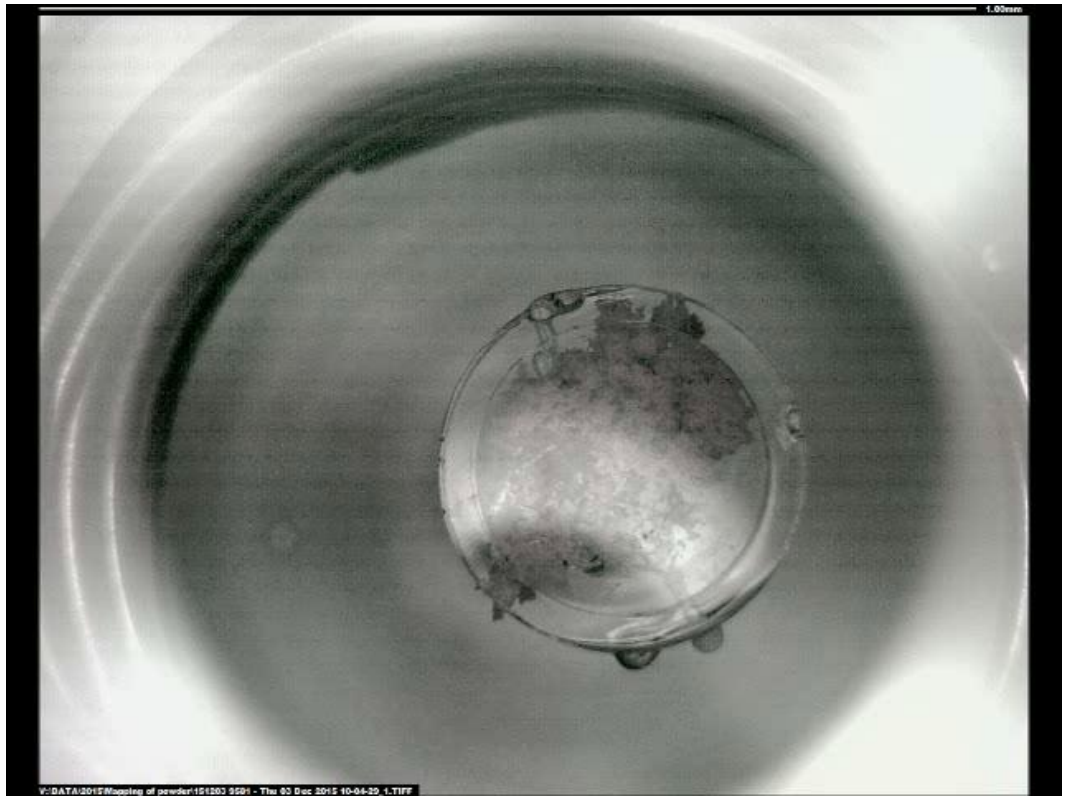

20 µm
High-vac. SEI PC-std. 15 kV x 1000 06-03-2014 000030

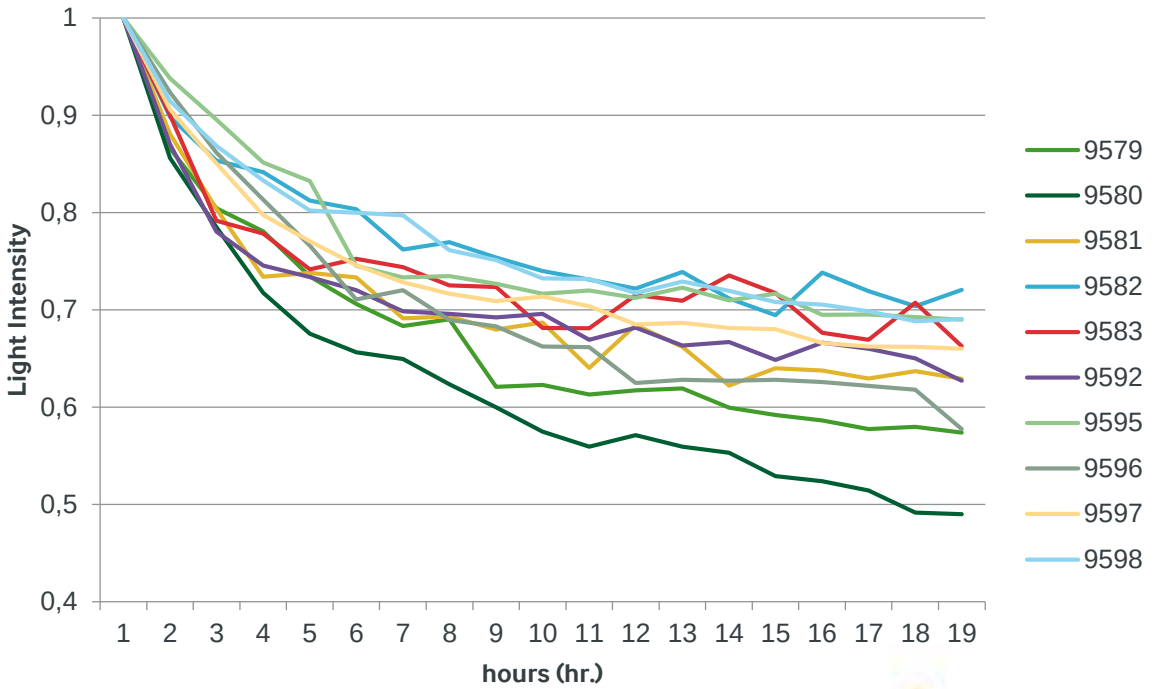
Trial

30°C, 50-0-100 P/P_0, 2 cycles, step size 10



Browning
Maillard reaction





Challenges

- Sampling
- Particle size distribution
- Reproducibility
- High temperature