ECN

Energy research Centre of the Netherlands

$MgSO_4$ measurements (first measurements)

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Types of measurements

- Actual:
  - TG & semi-DTA
    (controlled moisture)
  - DSC (controlled moisture)
- Future
  - Corrosivity tests
  - Cycling & DSC
  - Conductivity
  - Phase diagrams

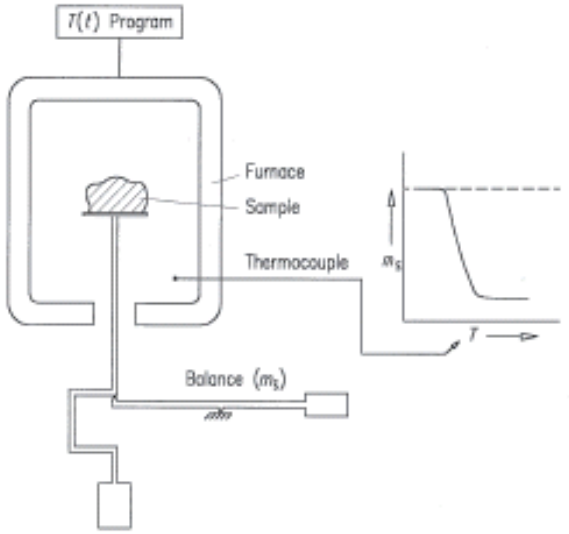


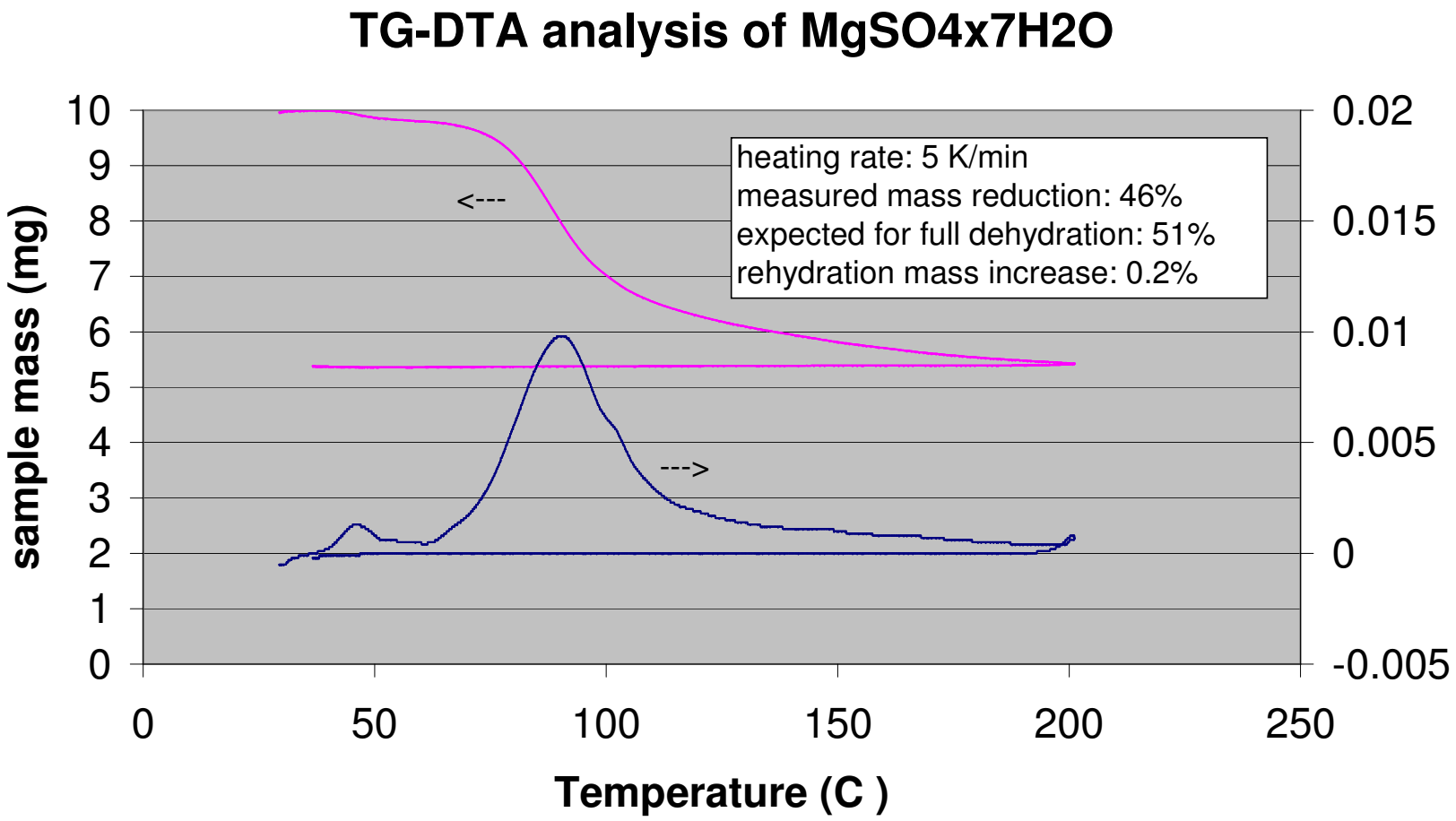
Figure 9. Basic set-up of a thermobalance.

Types of measurements

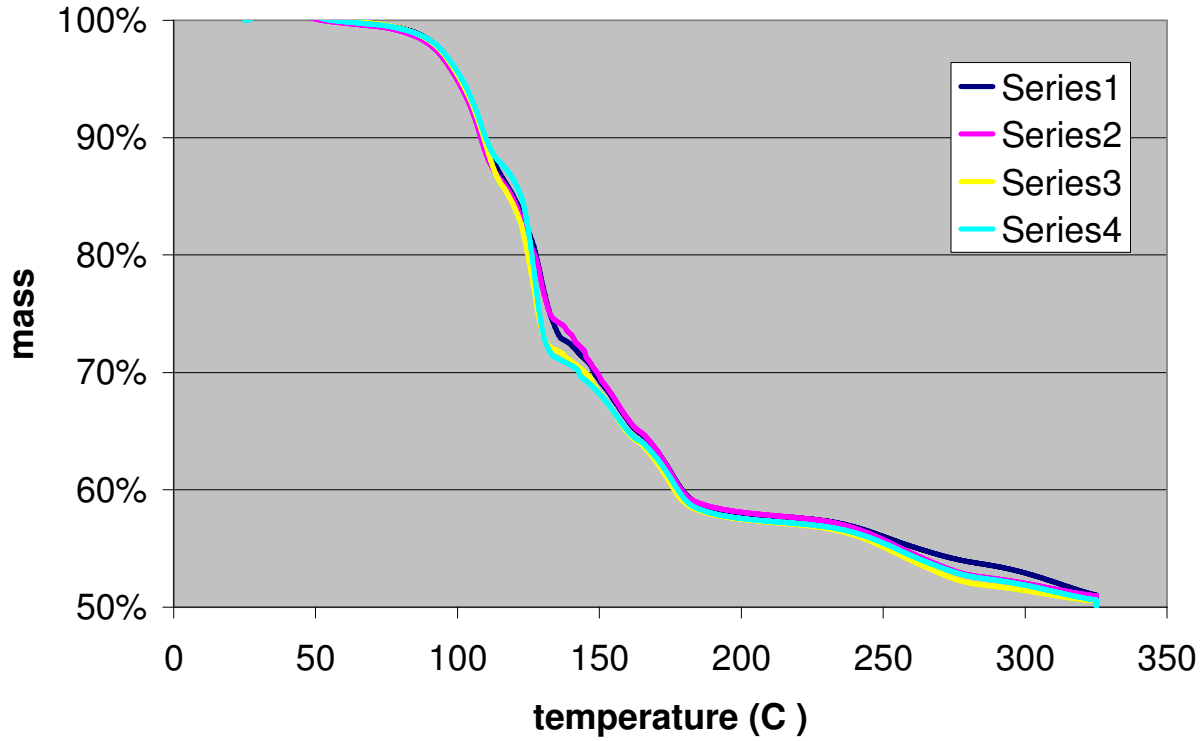
- From TG-DTA & DSC tests
  - Reaction steps (amount & temperature)
  - Reaction rate
  - Heat capacity

Present measurements are carried out by Ilse vd Voort for her MSc project

TG – typical result



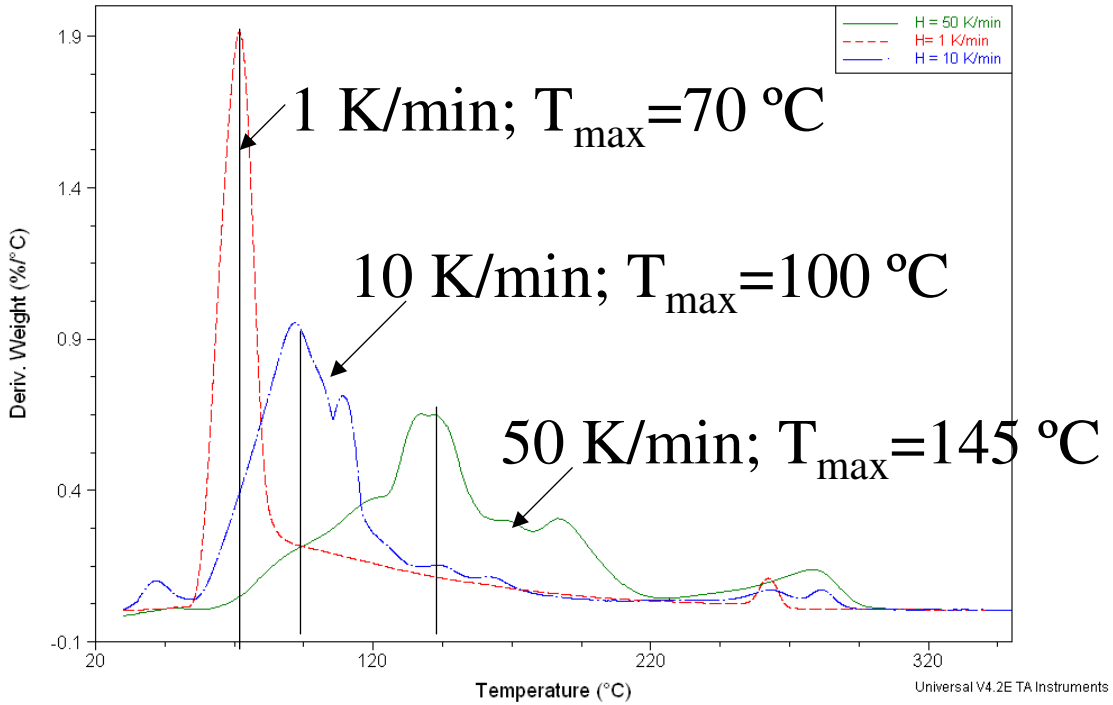
TG – reproducibility



The measurements are fairly reproducible

Heating rate: 10 K/min

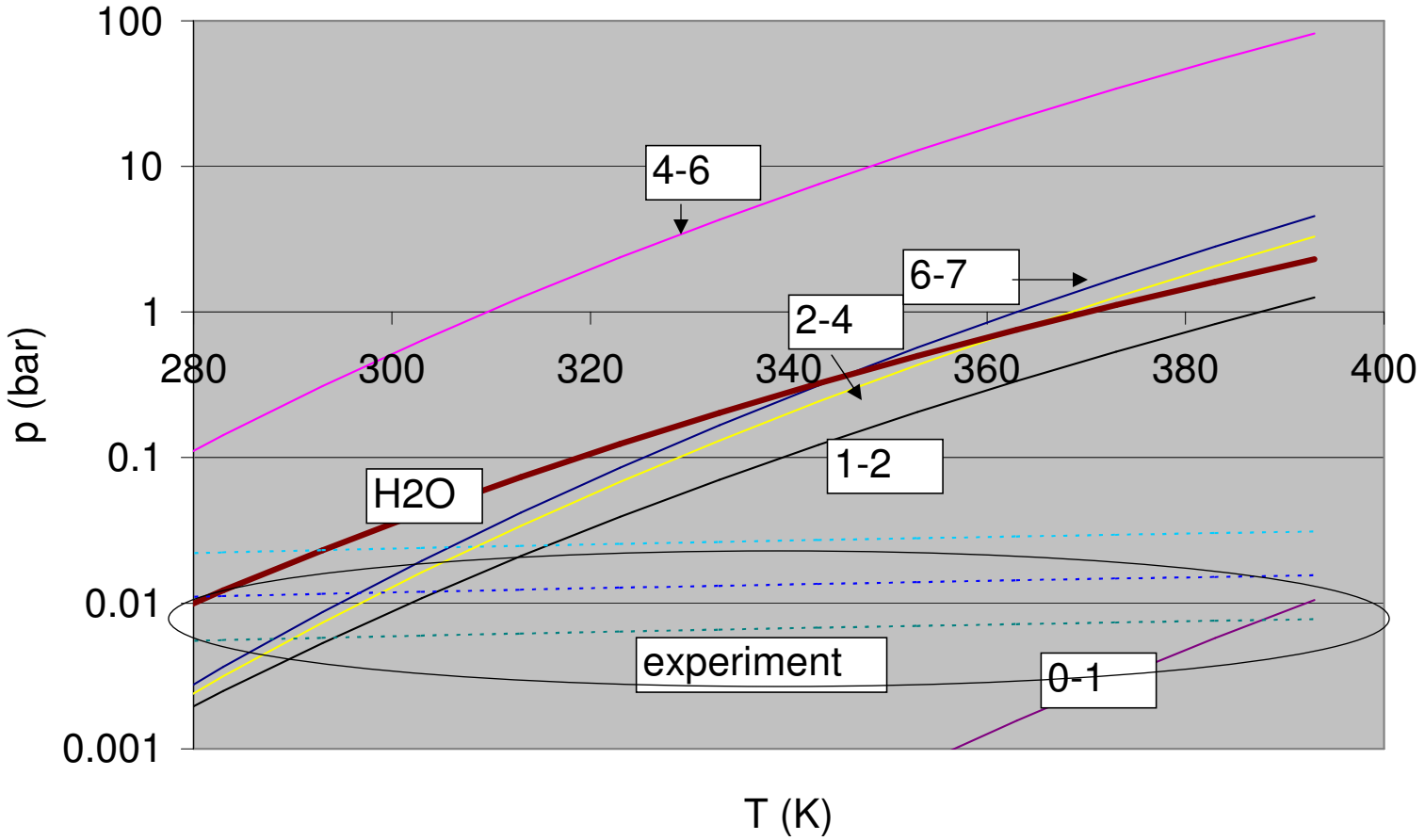
TG – effect of heating rate



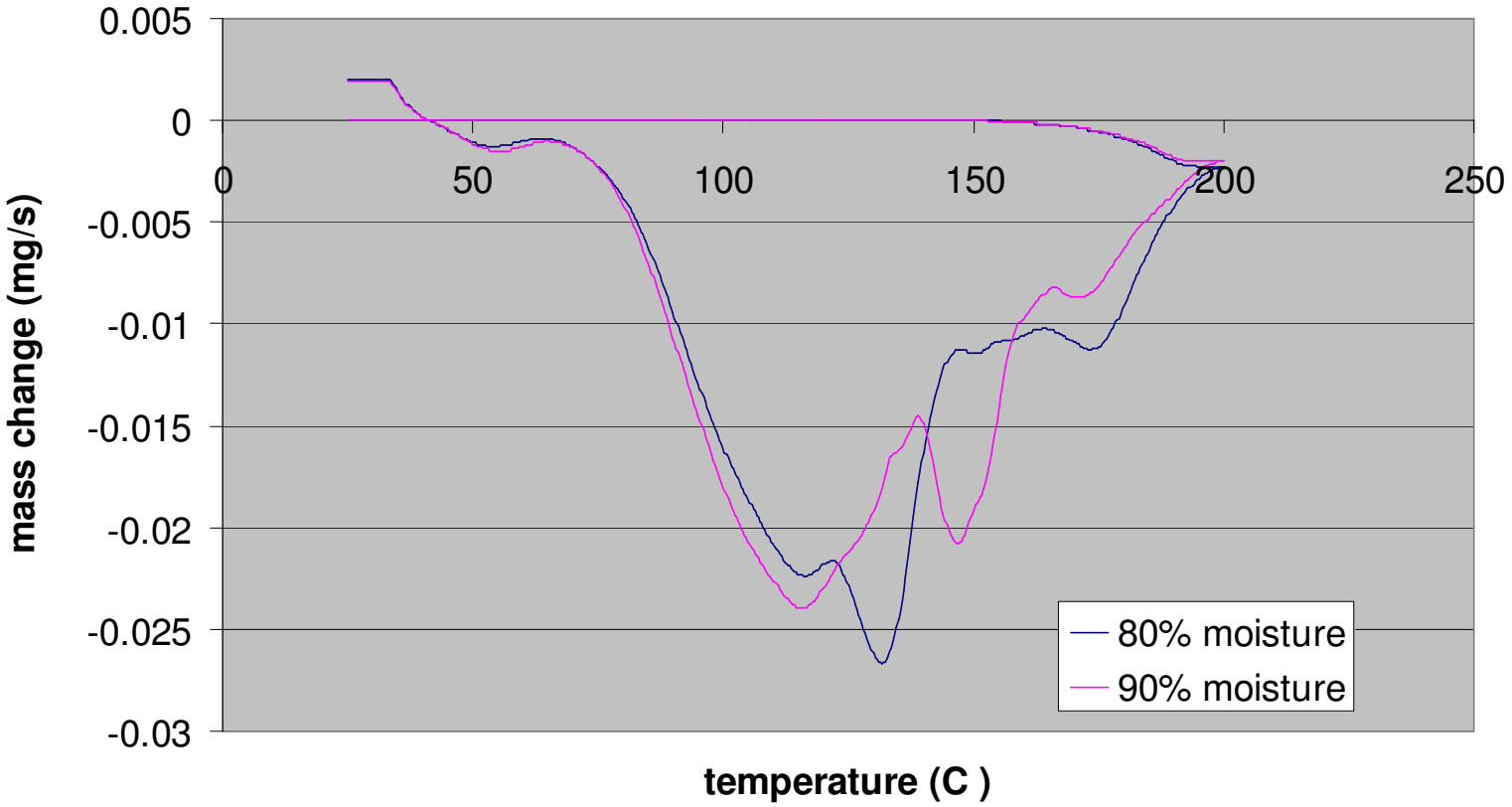
Heating rate strongly affects

- The peak temperature position (further from equilibrium with increased rate)
- The observed amount of rehydratation (decreases with increased rate)

TG – effect of moisture content

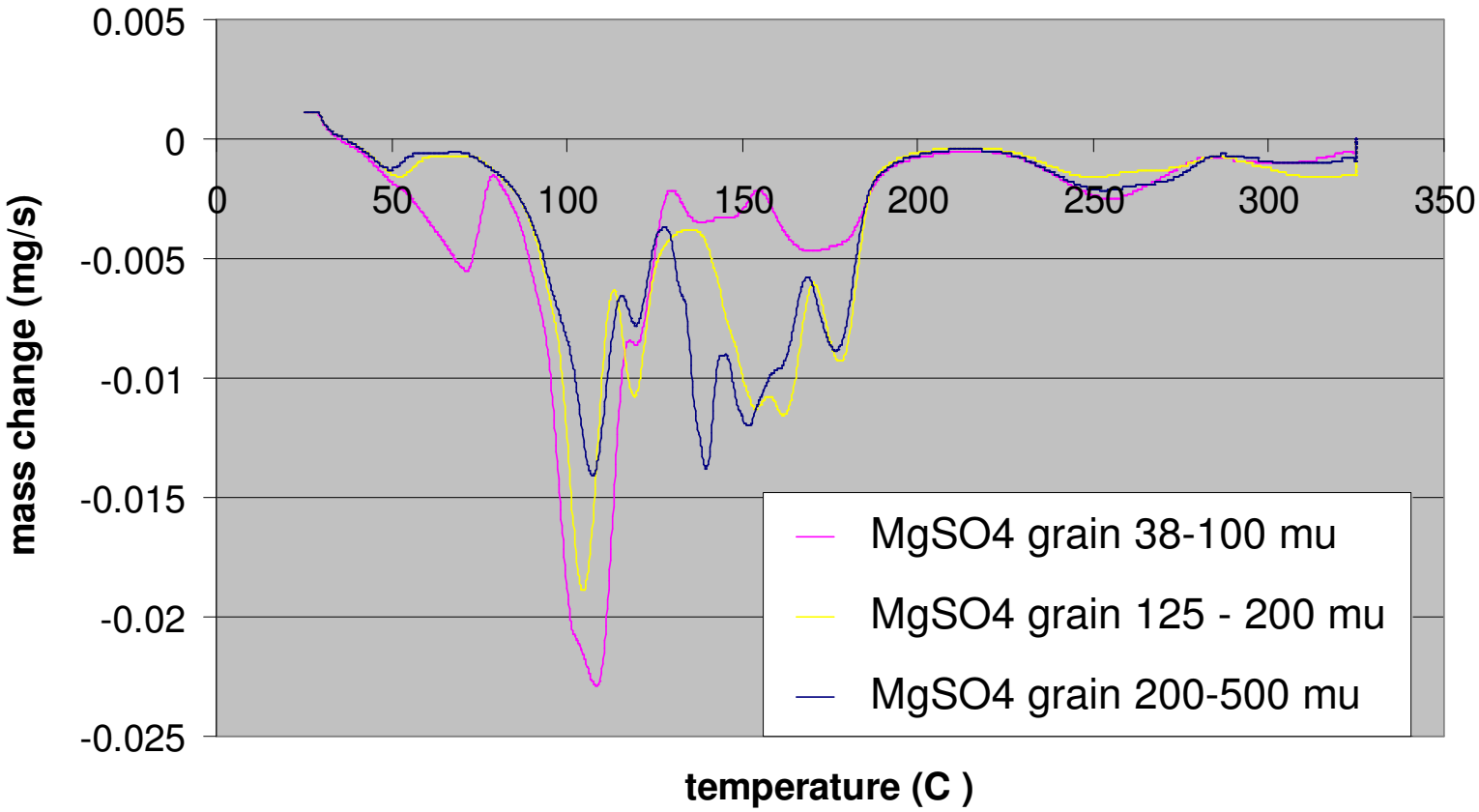


TG – effect of moisture content



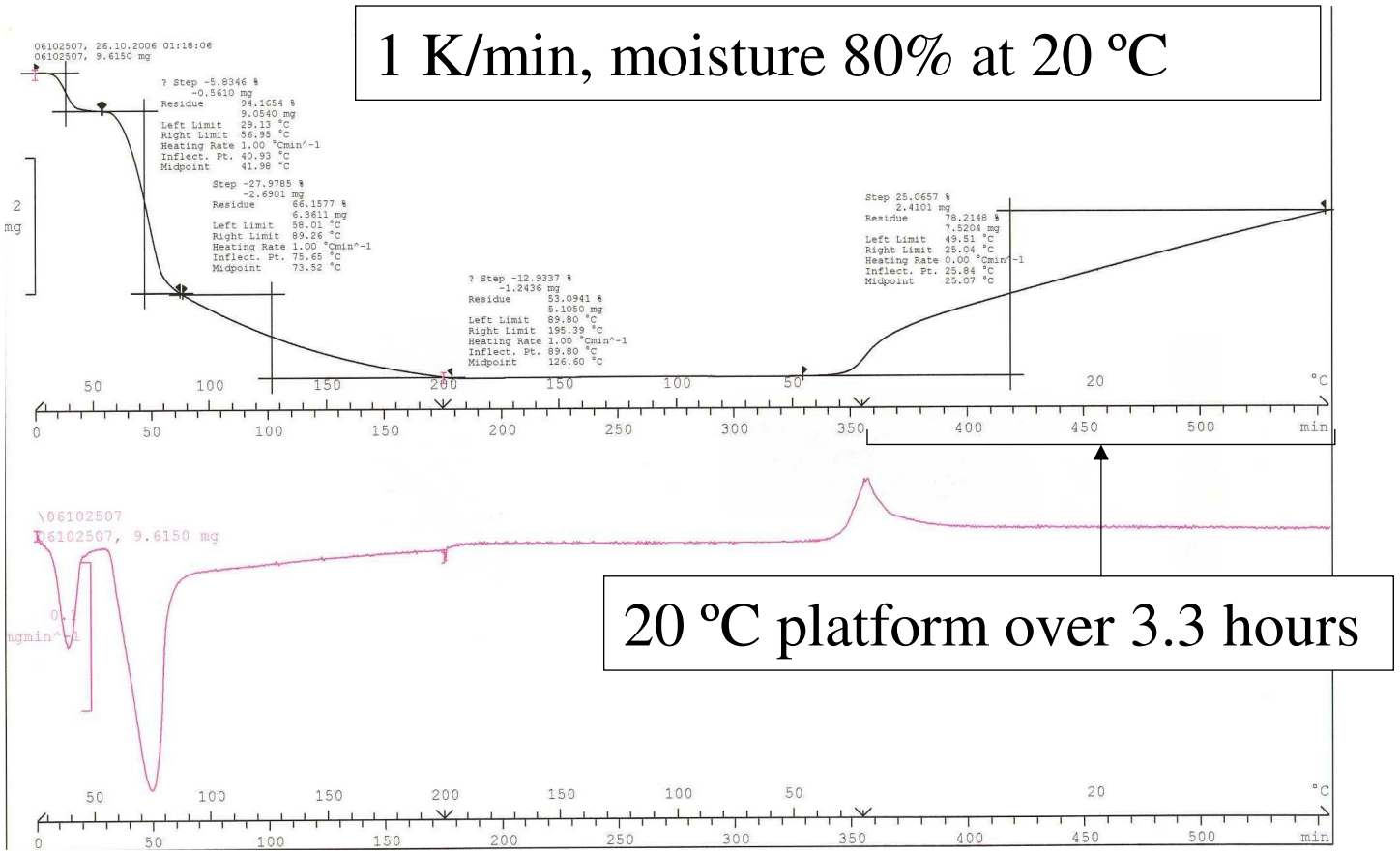
Heating rate: 20 K/min

TG – effect of grain size



Heating rate: 10 K/min

TG - Rehydration



Melting

Higher hydrates have lower melting point; too fast heating may melt TCM.

Melting and recrystallising strongly reduces surface area => reaction becomes too slow

Powder converted to caked mass by heating to 120 °C with 6 K/min
=> beware!

Preliminary conclusions

- Necessary to be careful in the interpretation of the measurements
- Measure with low heating rate & small grains
- Peak temperature increases with vapour pressure
- $MgSO_4$ higher hydrates have insufficient energy for use