Determination of the spontaneous ignition behaviour of dust accumulations (Revision of EN 15188)

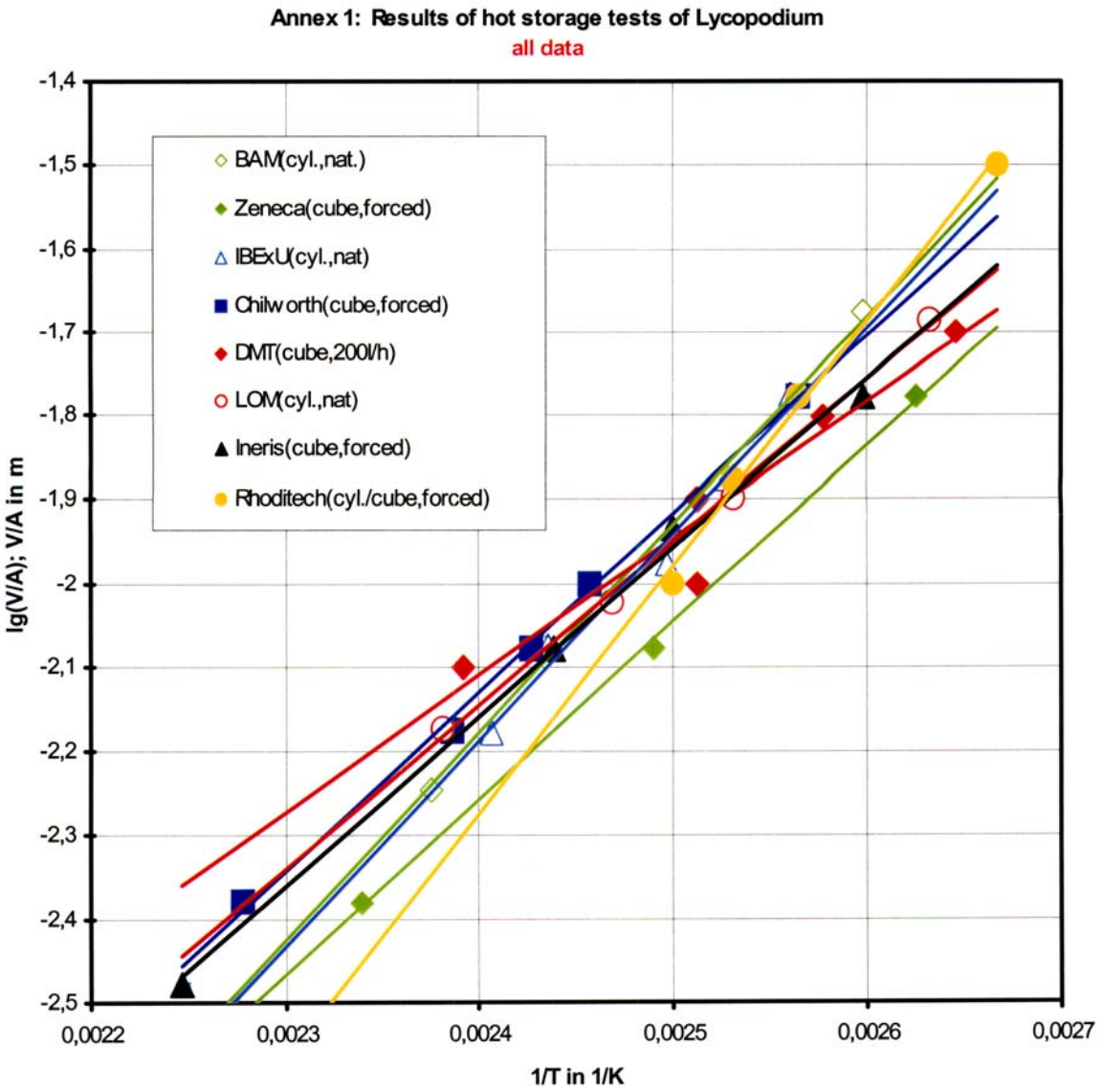
Stephen Puttick

CEN/TC305 - WG1

- Potentially explosive atmospheres - Explosion prevention and protection
  - WG1 - Test methods for determining the flammability characteristics of substances
- EN 15188
  - 2006 accepted for publication
  - BS 2007

History - Round Robin

- Lycopodium
- ~2000 (1999?)
- Later carbon
- Inert for oven temperature distribution



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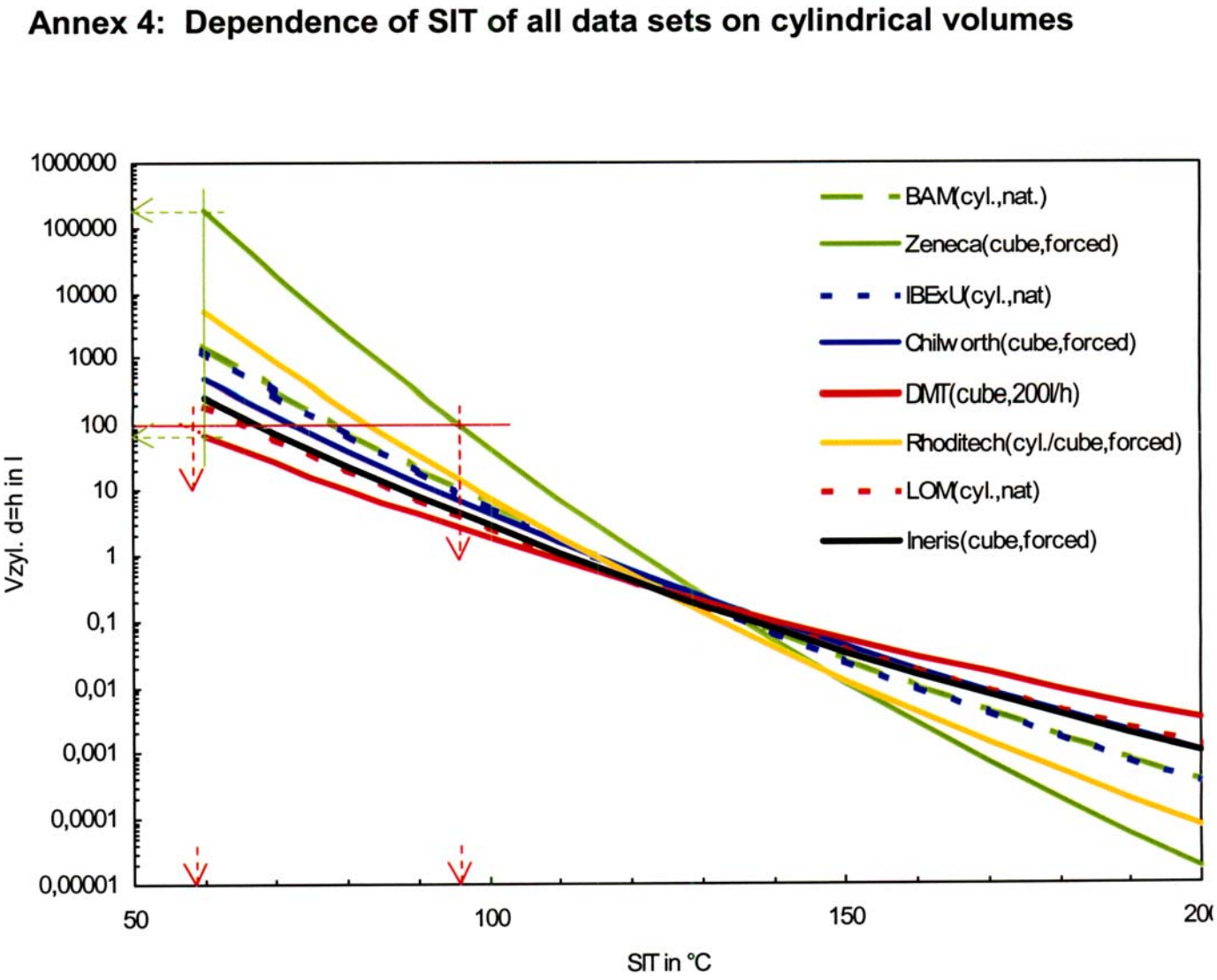
Extrapolation

- Following publication
  - Intention to revise
  - Implement solutions & testing



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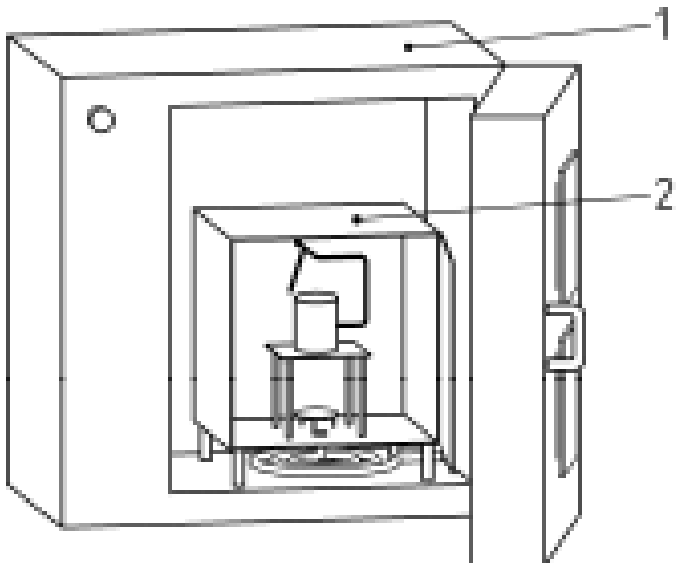
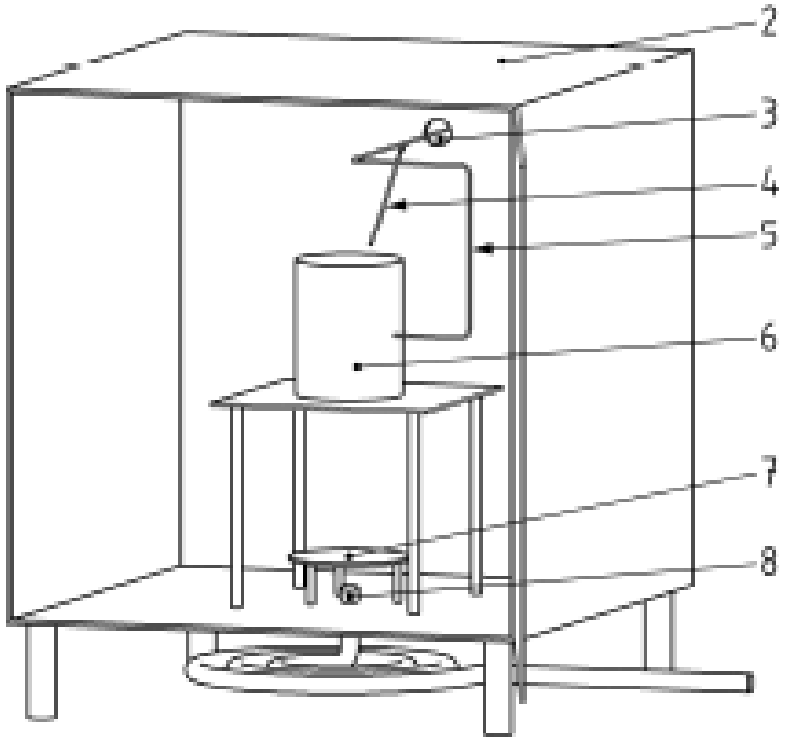
Solution for published standard – Inner Chamber





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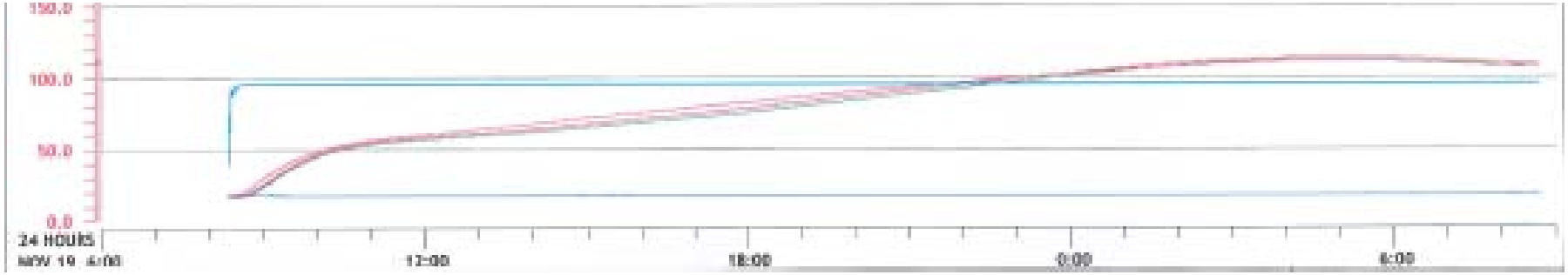
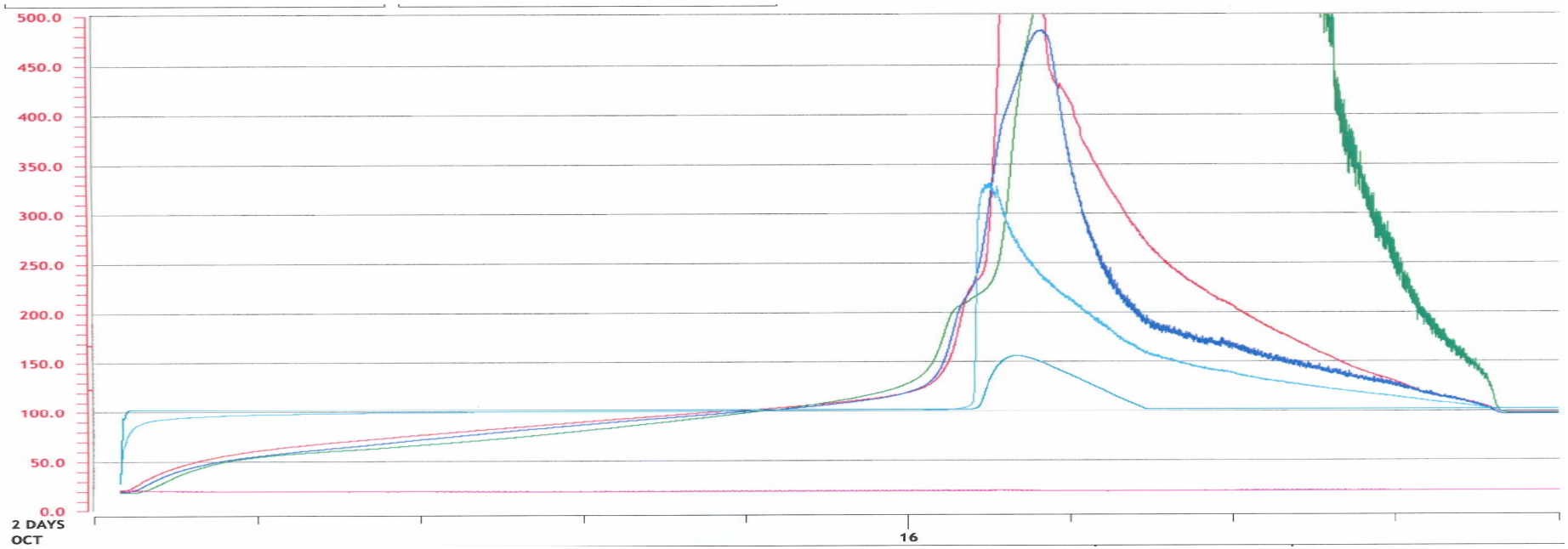
Related background

Sub and super critical experimental data





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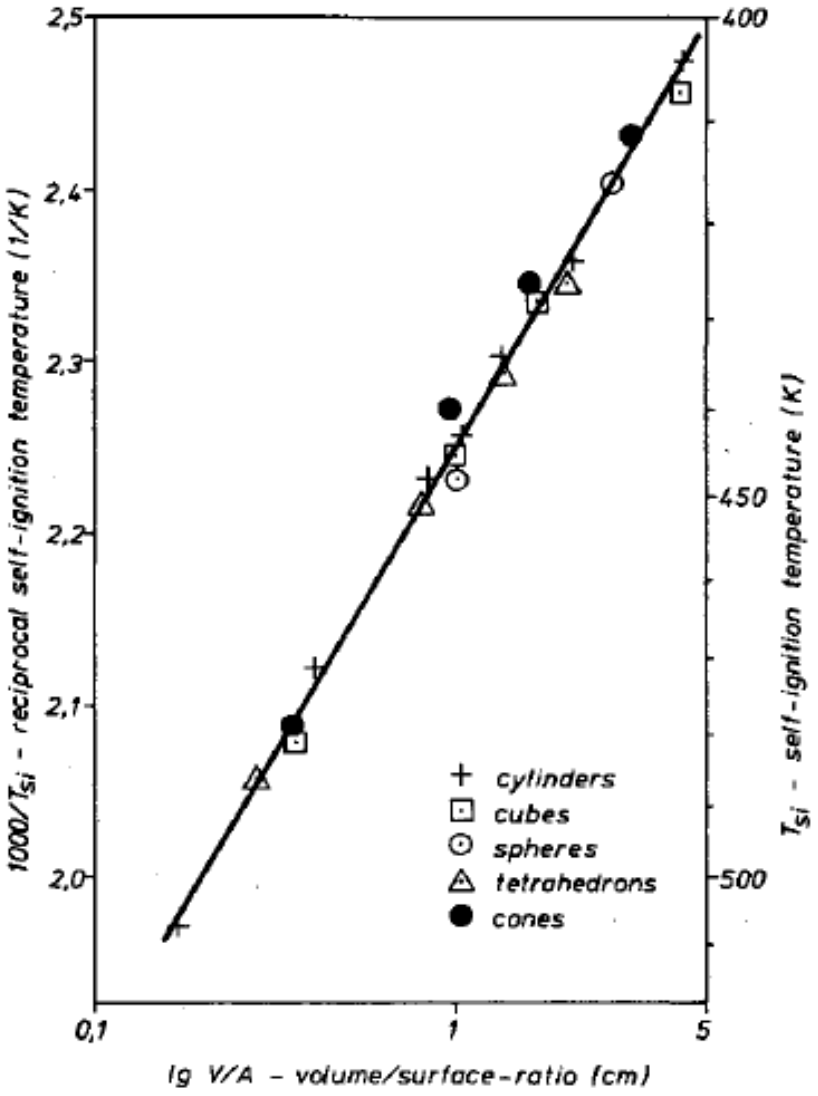
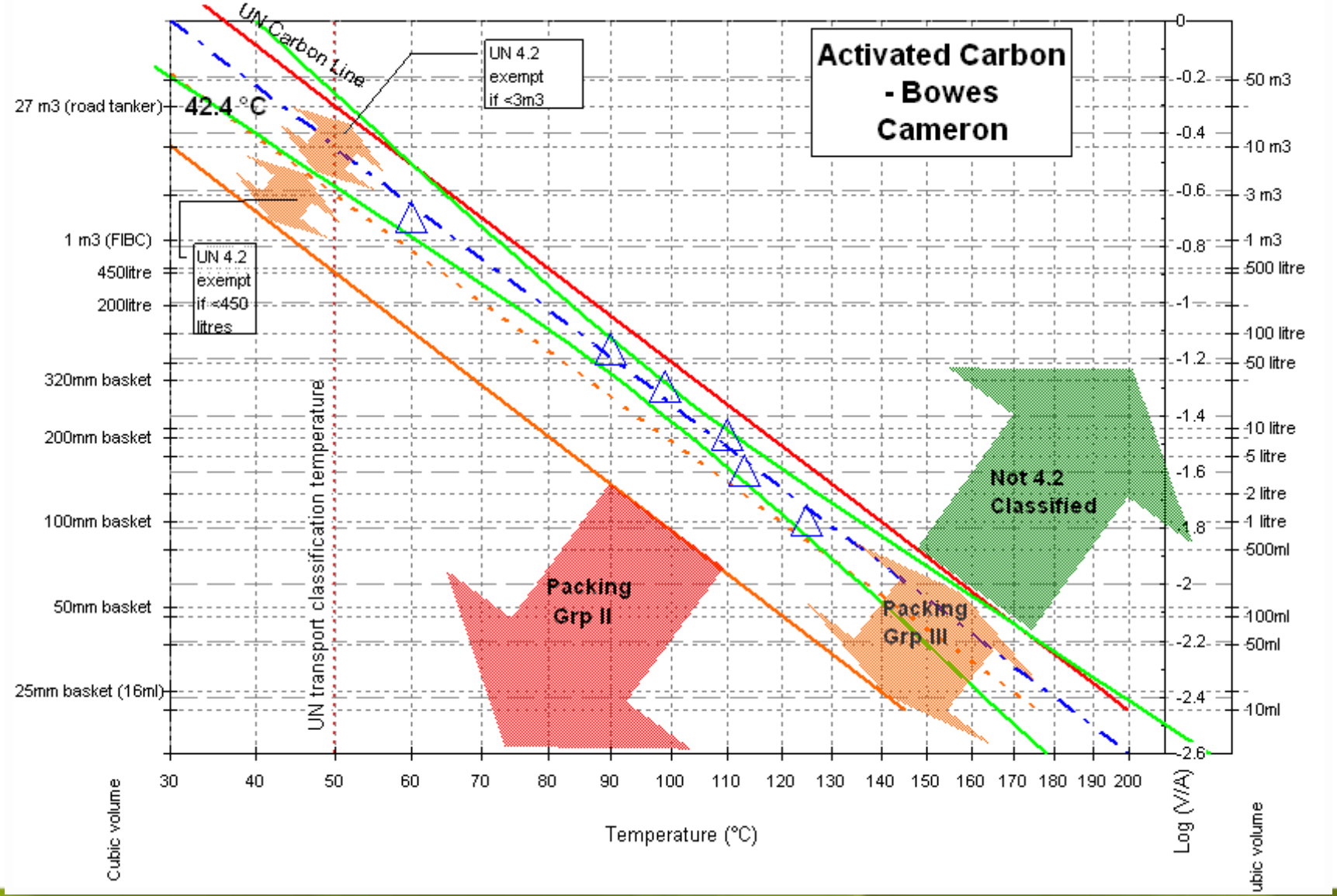
Leuschke

- Different shapes
- Log V/A vs $1/T_{si}$



Bowes & Cameron data



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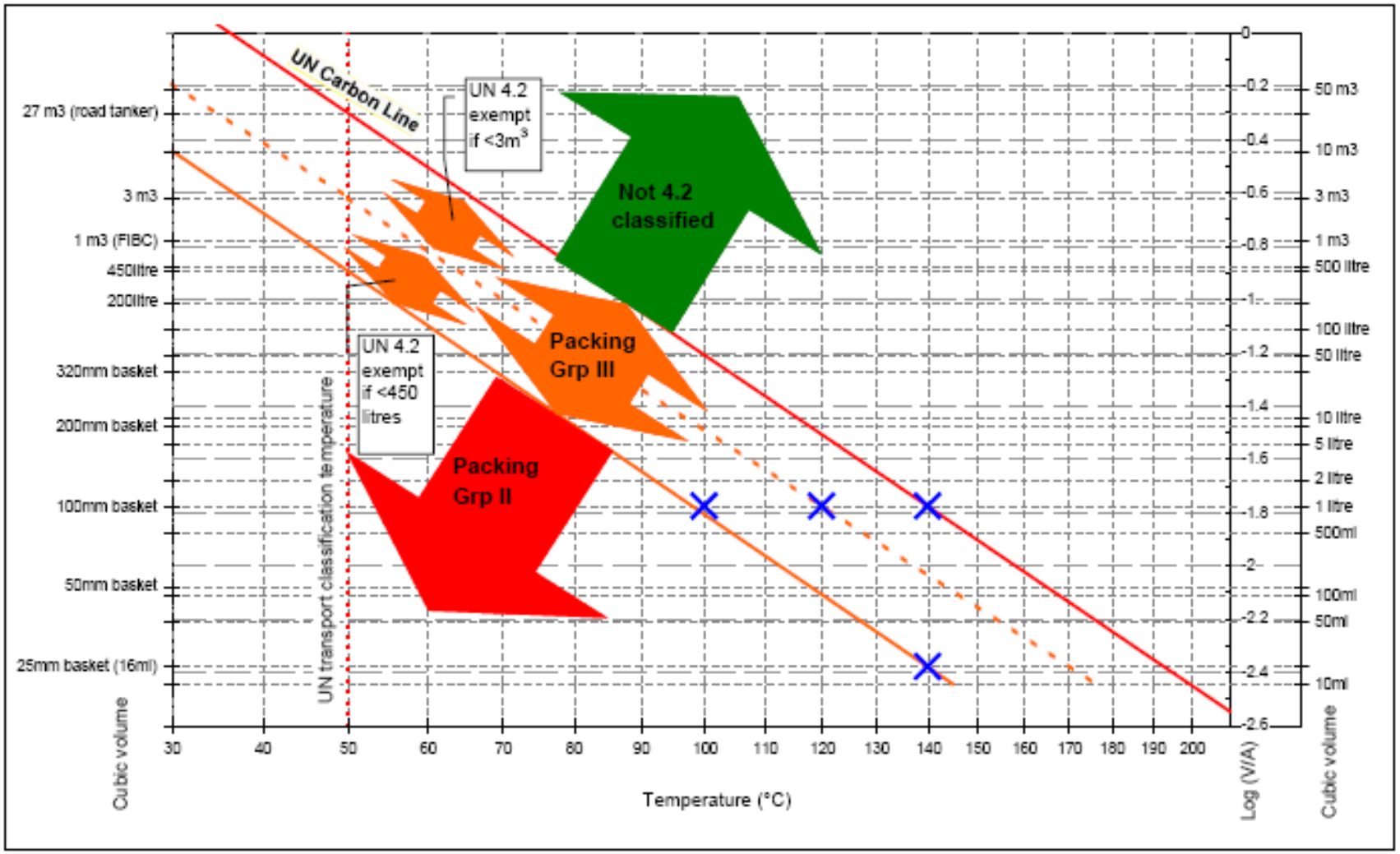
Basket testing – UN transport framework



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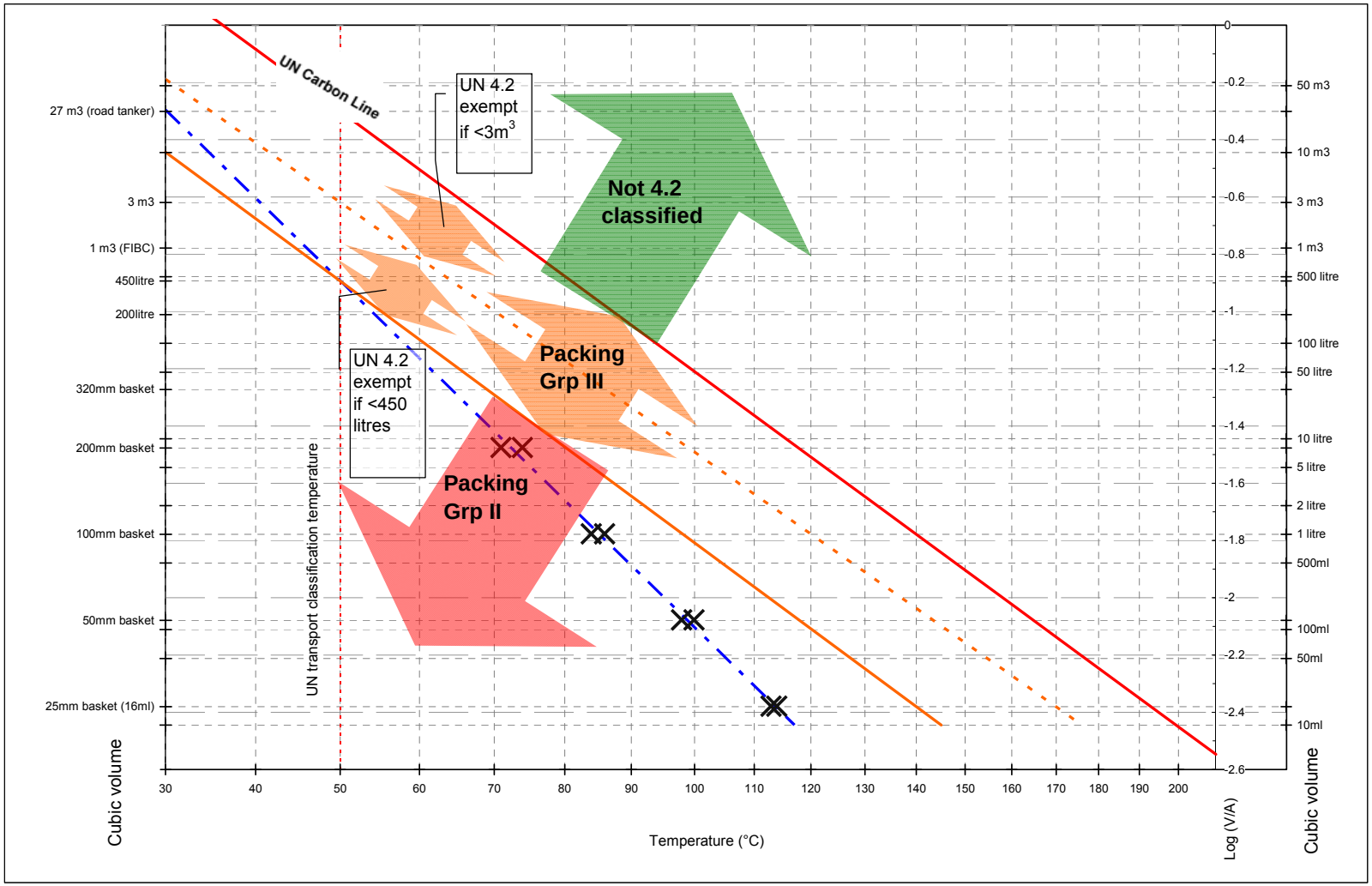
Can exempt



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UN cage/shield on bench

- As used by Syngenta
  - And previously Zeneca
- Wire gauze

New “Mini-Round Robin”

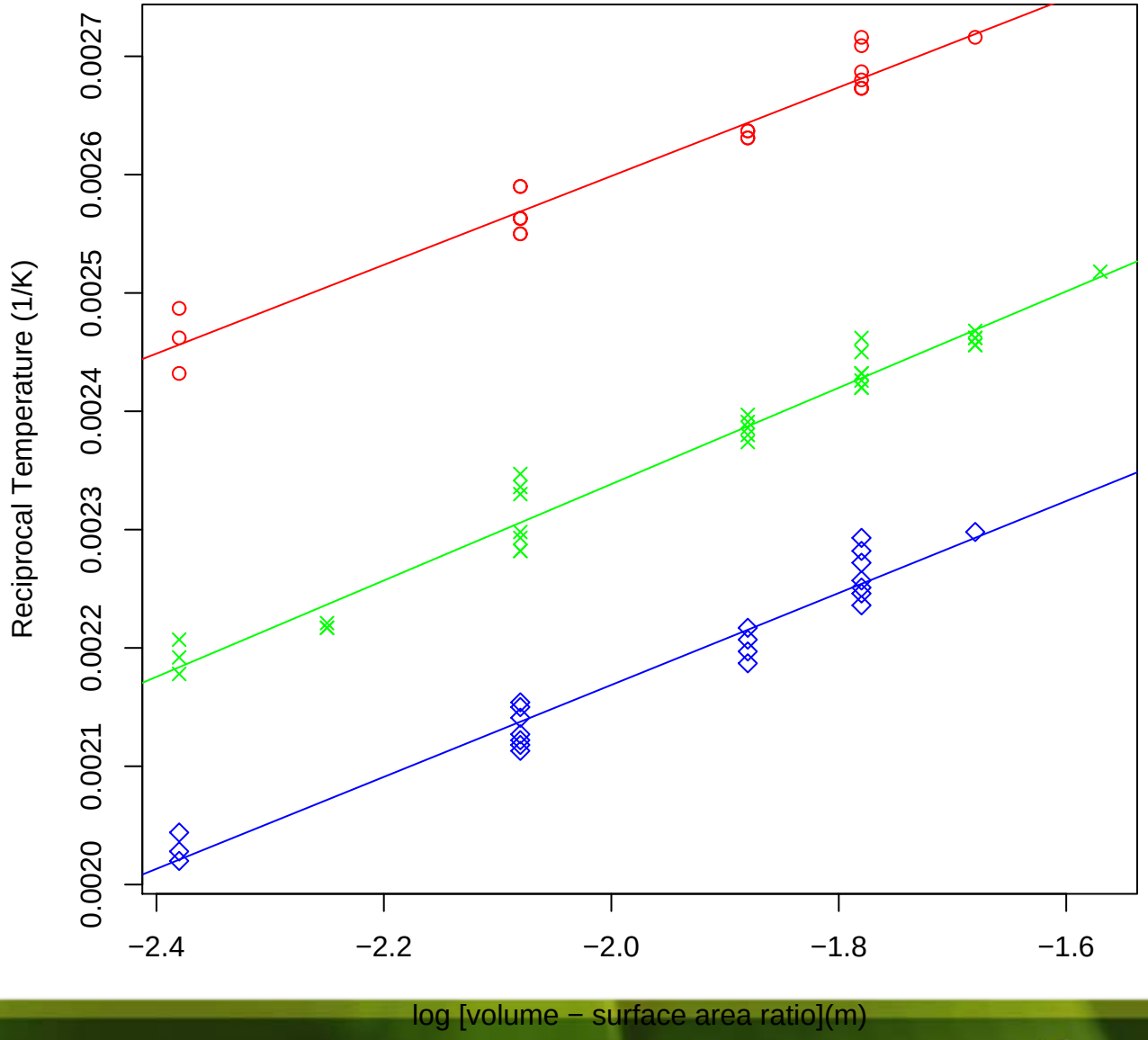
Syngenta & BAM

BAM cage/shield in oven

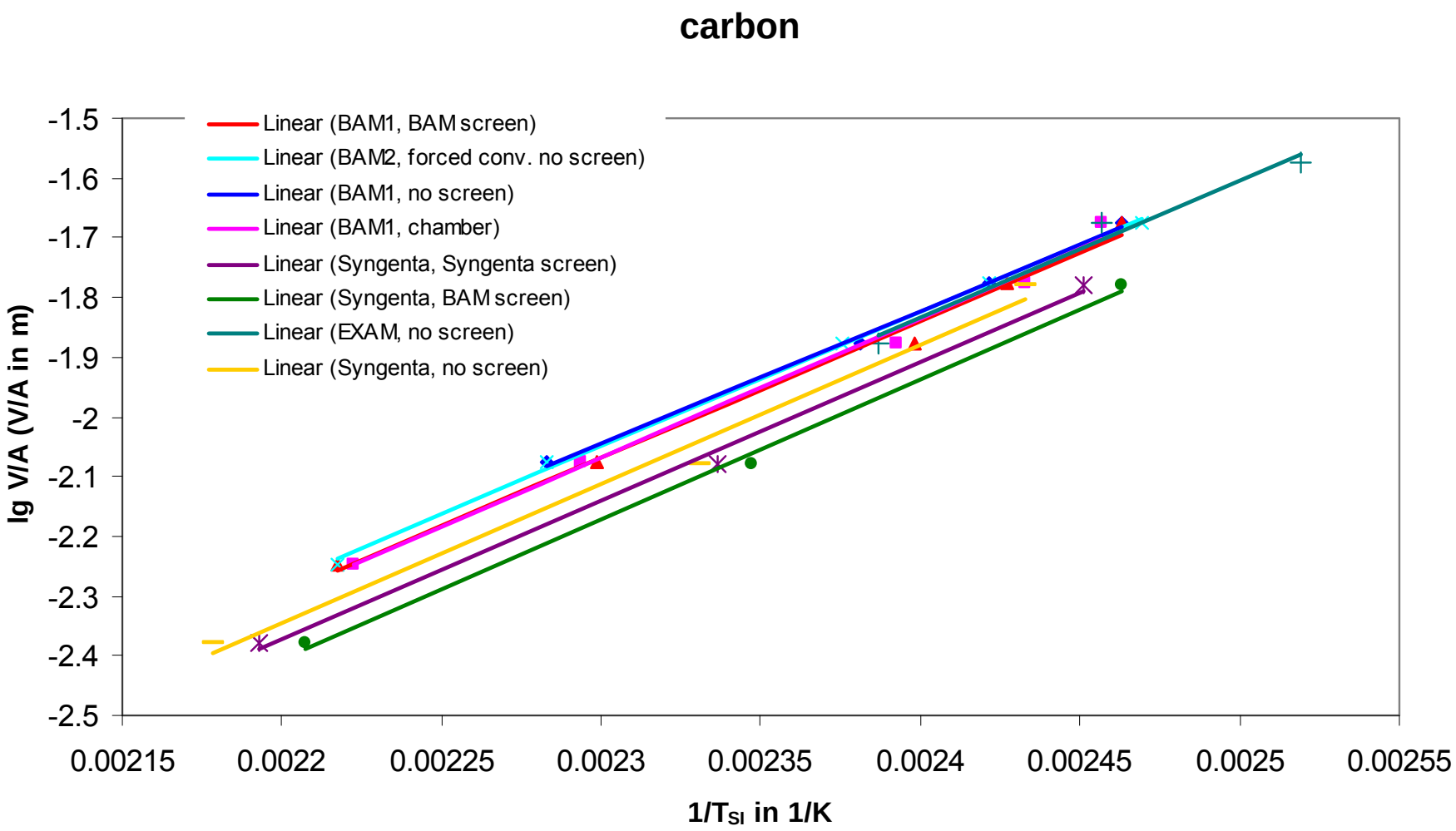
- BAM cage has mesh over upper surface

All 3 sets of data

- Coal
- Carbon
- Cork



Carbon – supplied by Syngenta



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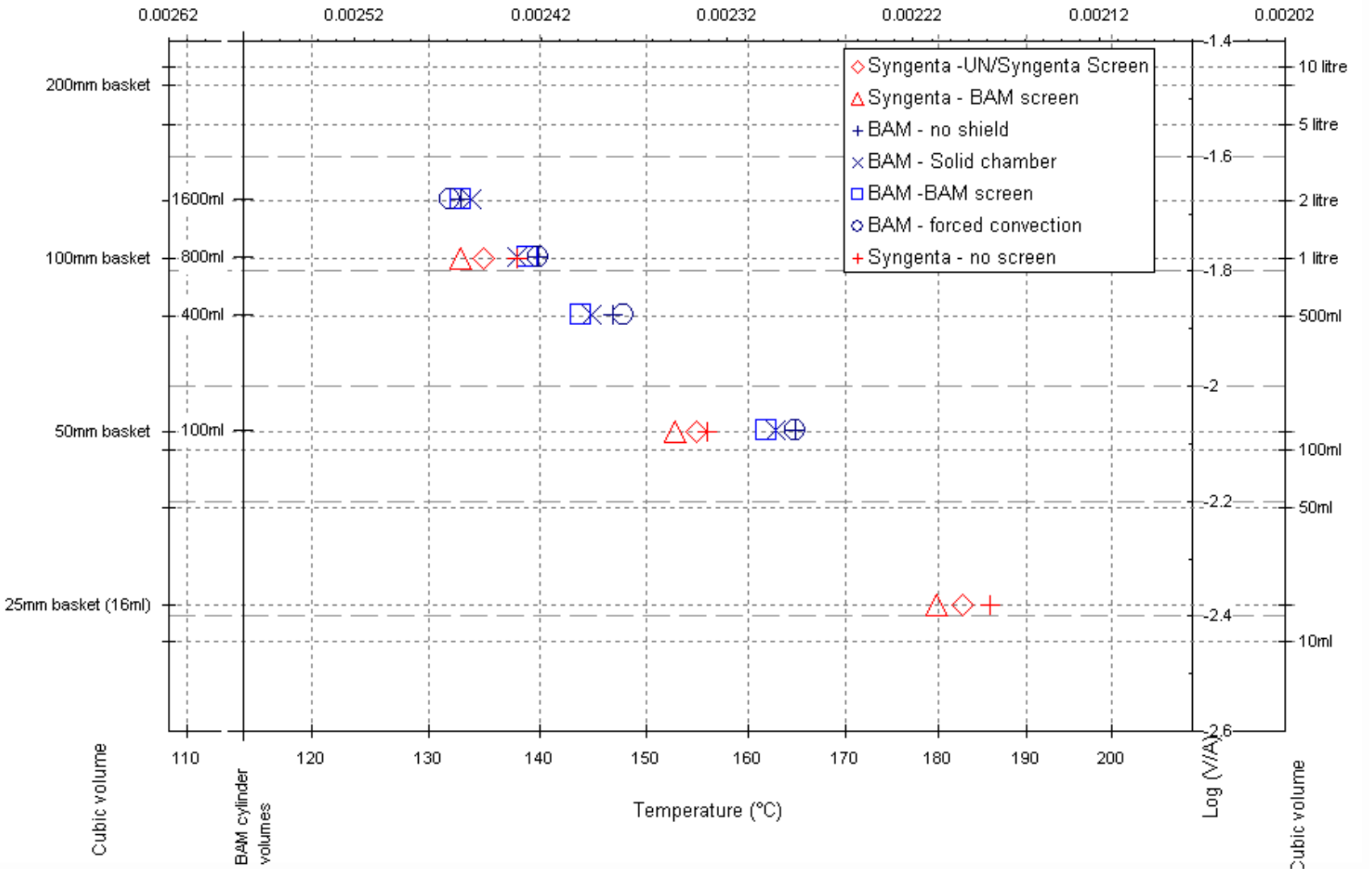
Plotted differently – carbon (Syngenta-Red, BAM – blue)



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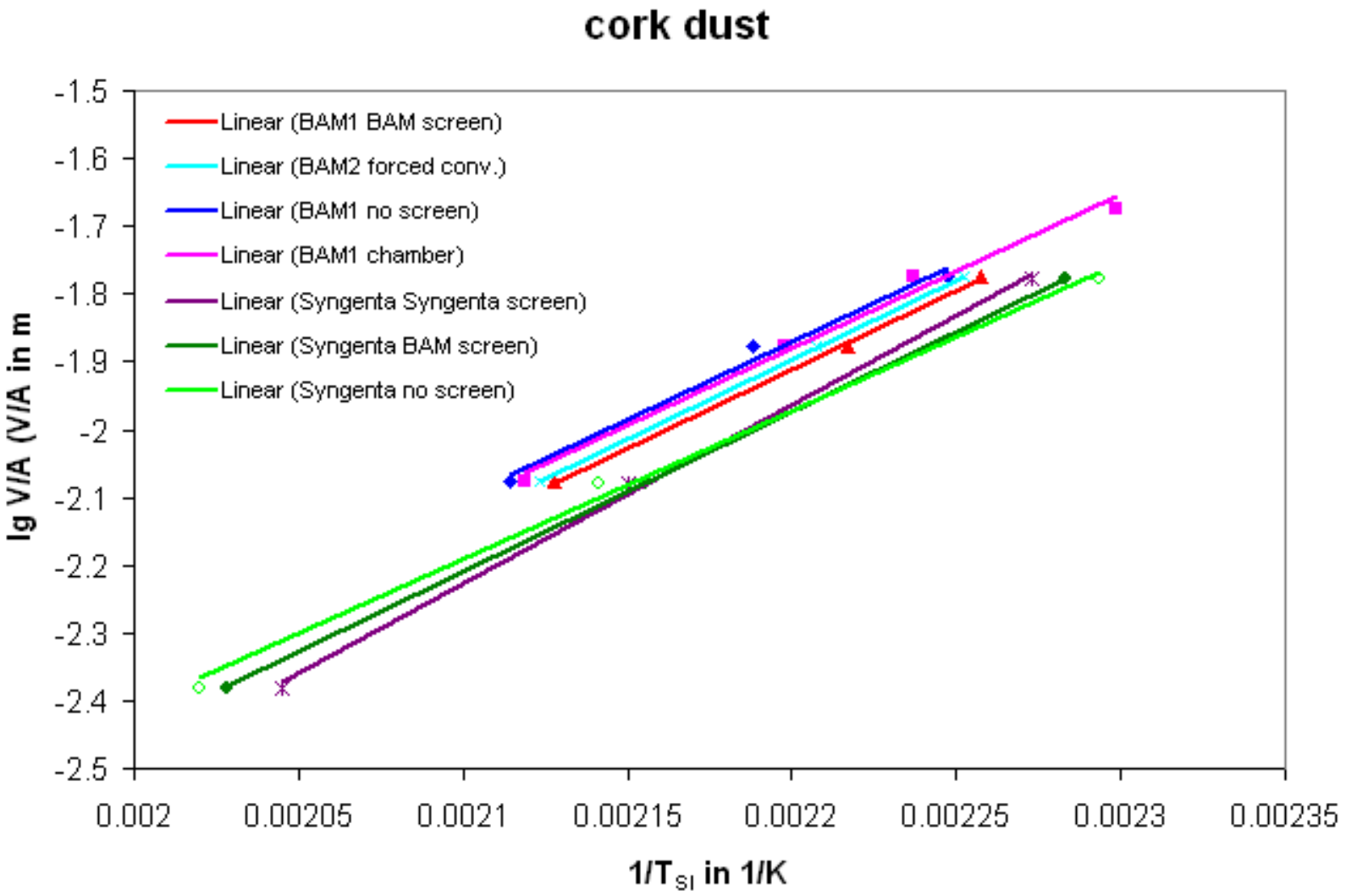
Cork Dust



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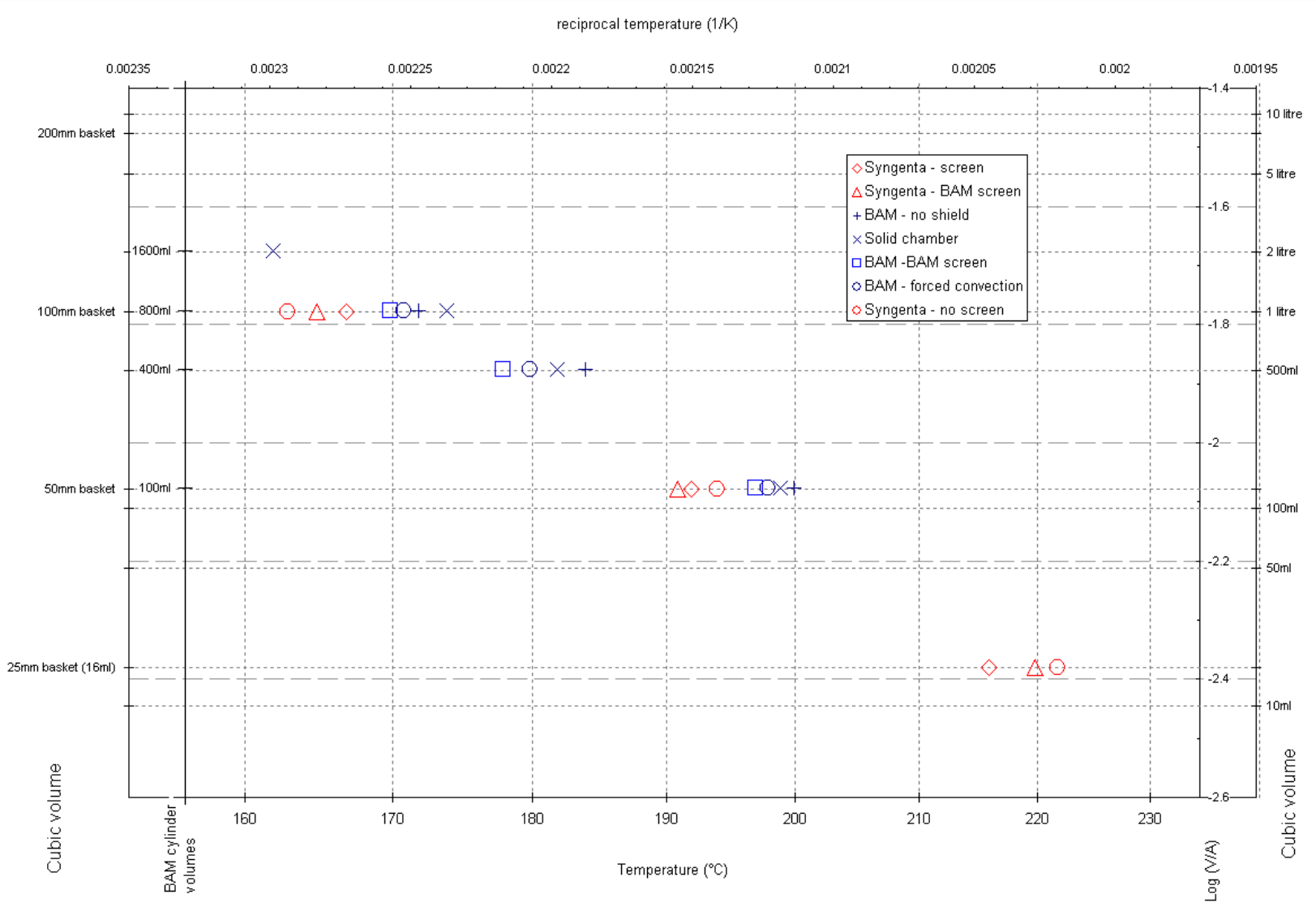
Cork



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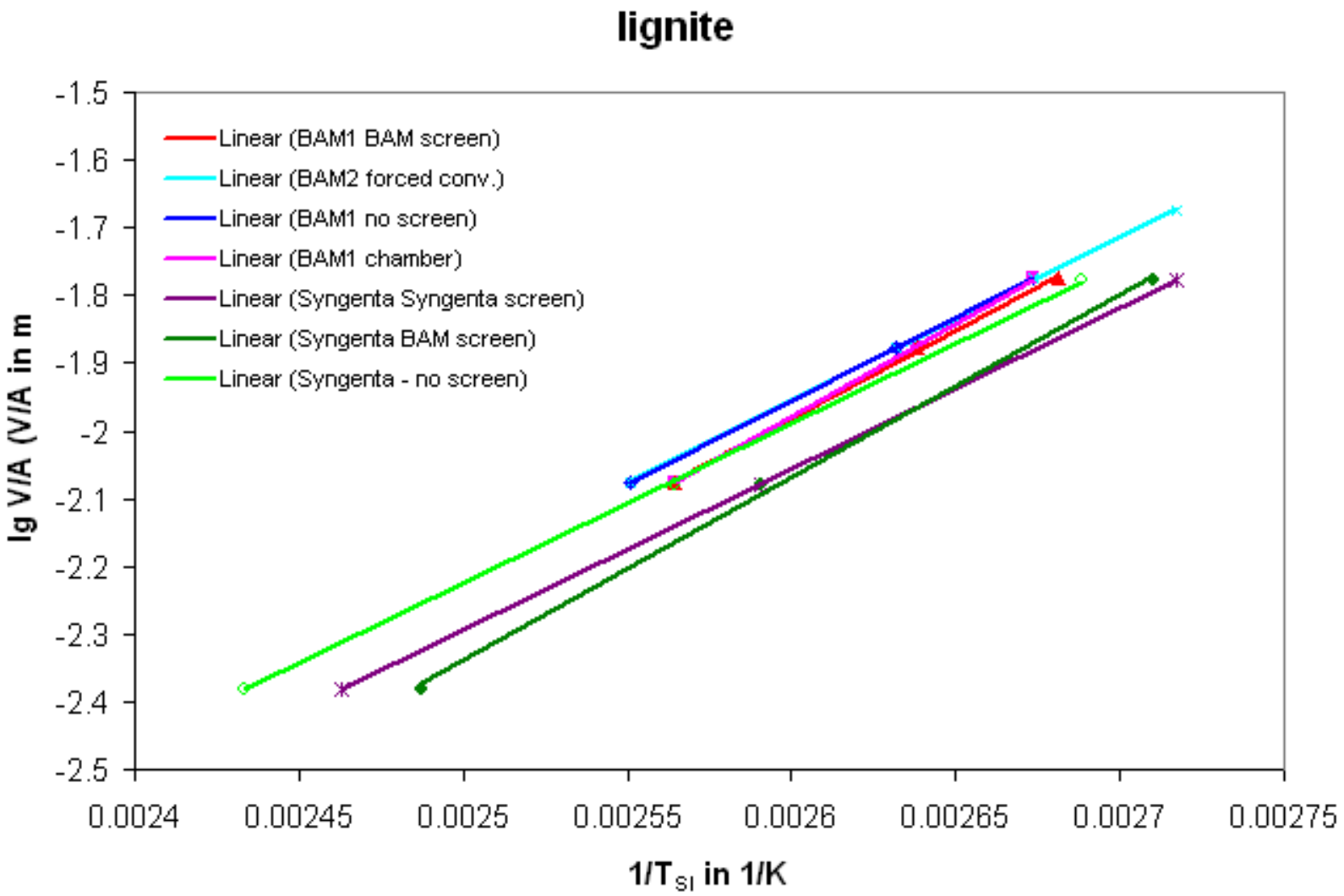
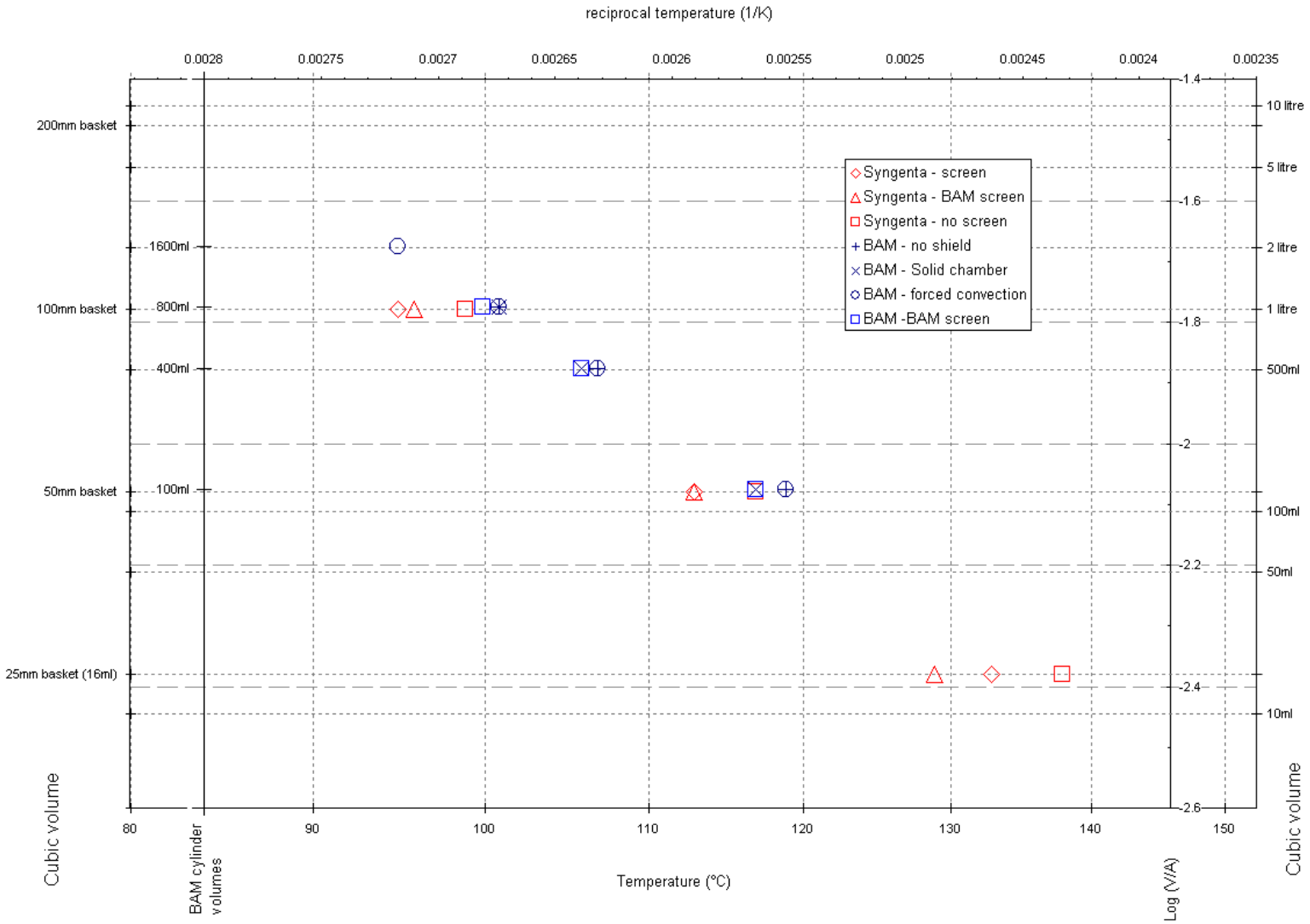
lignite



Lignite data – alternate view



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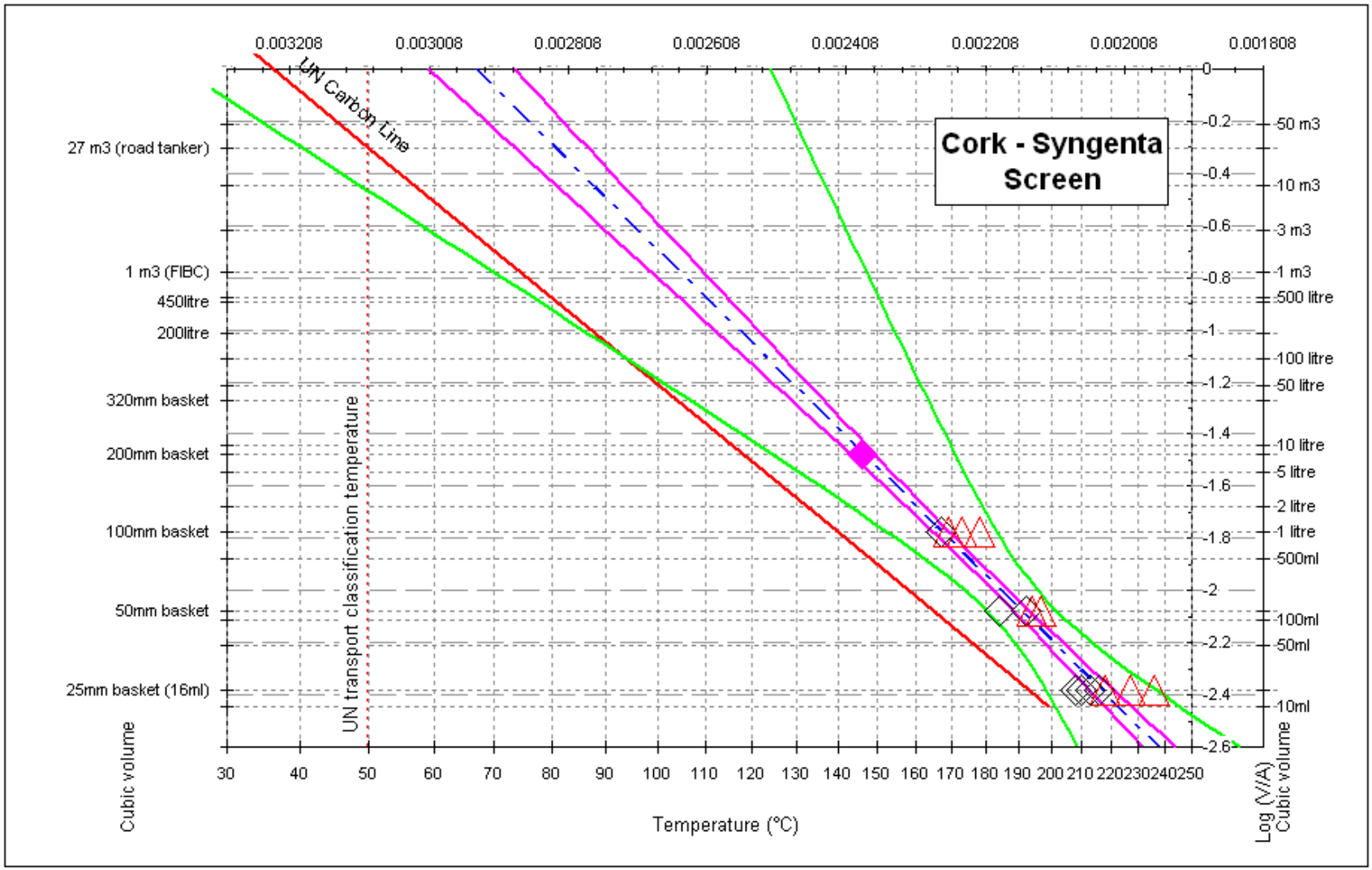
So what have we noticed/learnt

General observations and statistical conclusions

- Main difference laboratory
- Confounding
- Many differences not statistically significant
  - Small data sets
- Difference between gauze/shield and no shield
- Inner chamber not significantly different to any other configuration
- Experimental design

Uncertainty / Confidence



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Other observations

- Appendices – extrapolation
- Frank- Kamenetskii, Thomas or numerical methods
  - FK – high Biot – forced convection
  - FK & Thomas – measurement of other parameters
  - Numerical still rely on kinetics from experiments
    - Uncertainty
- What are we going to do with data?
- Type of kinetic behaviour

Large Scale Oven

Large Scale Oven with IBC of Product for Testing

Any questions?