Specific heat measurements on epoxy samples CTD 528 and CTD 528-5vol% Gd_2O_3

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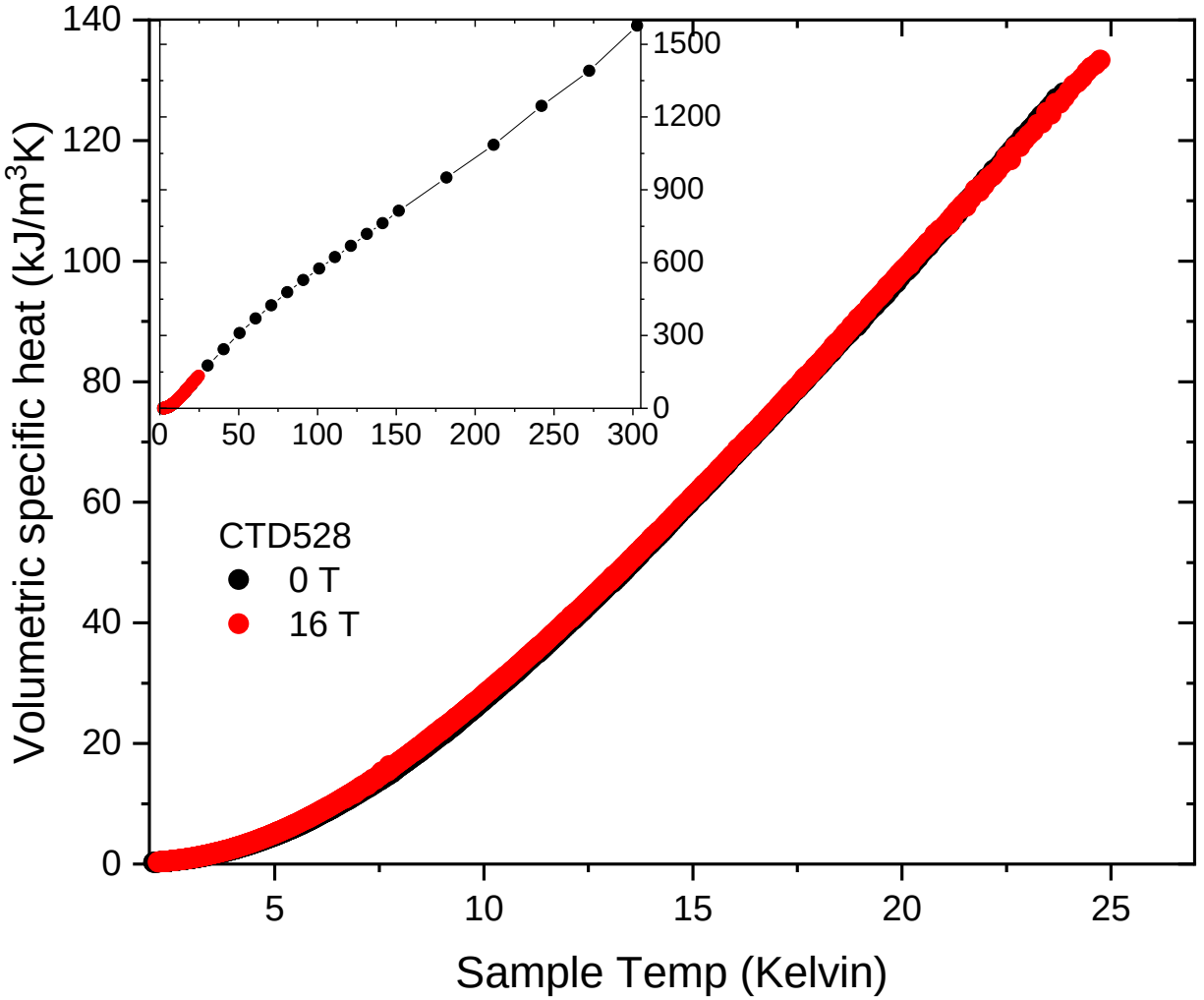
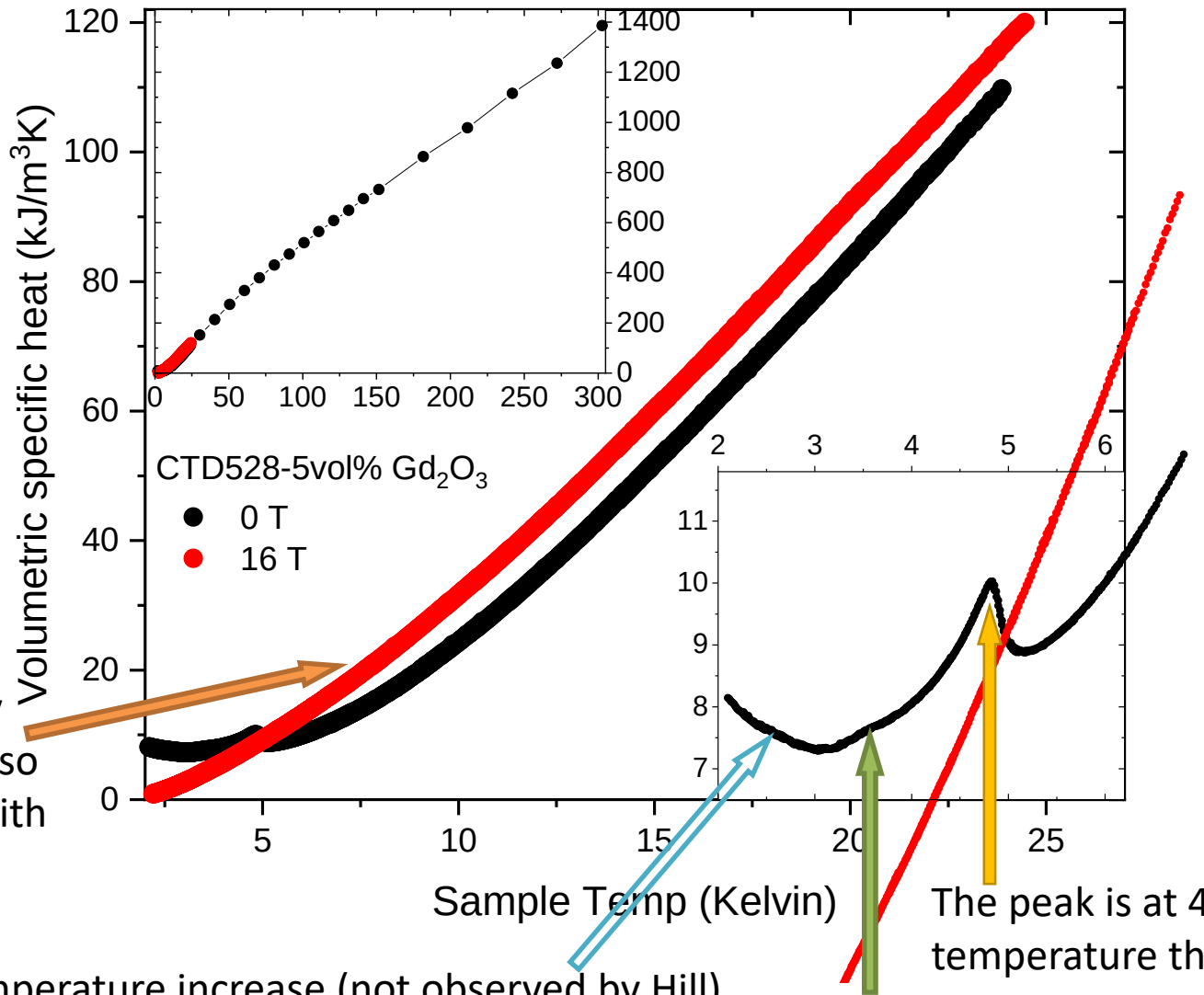
CTD 528: no significant difference applying field



Small variation of the in-field specific heat

CTD 528 – 5vol%. Gd_2O_3: clear suppression at 16 T



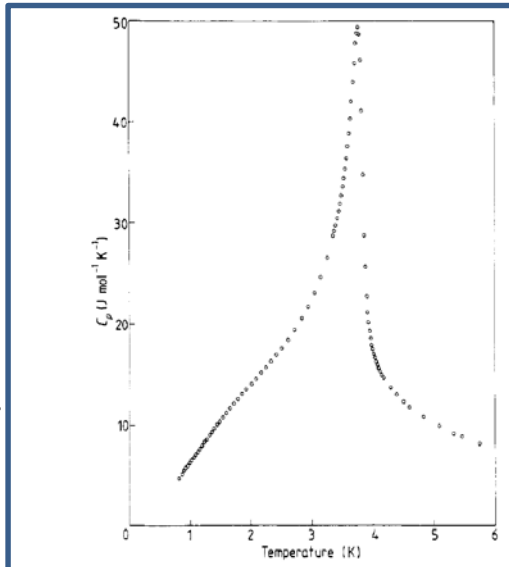


Figure 4. The specific heat of Gd_2O_3 below 6 K.

The presence of this peak suggests a monoclinic structure for Gd_2O_3

Previously a peak at 3.8 K was observed

R W Hill *et al* 1983 *J. Phys. C: Solid State Phys.* **16** 2871

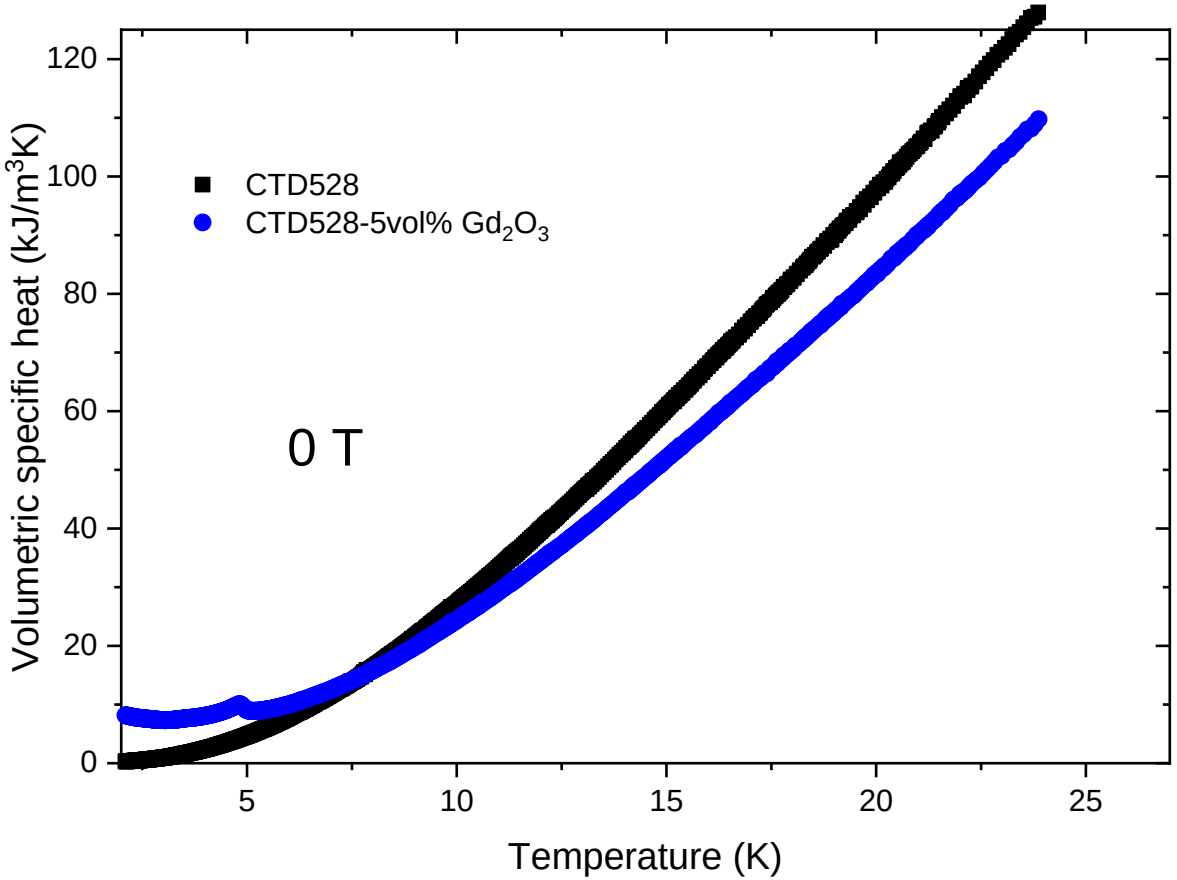
At 16 T the peak is completely suppressed but the curve is also significantly shifted upward with respect to the 0 T curve

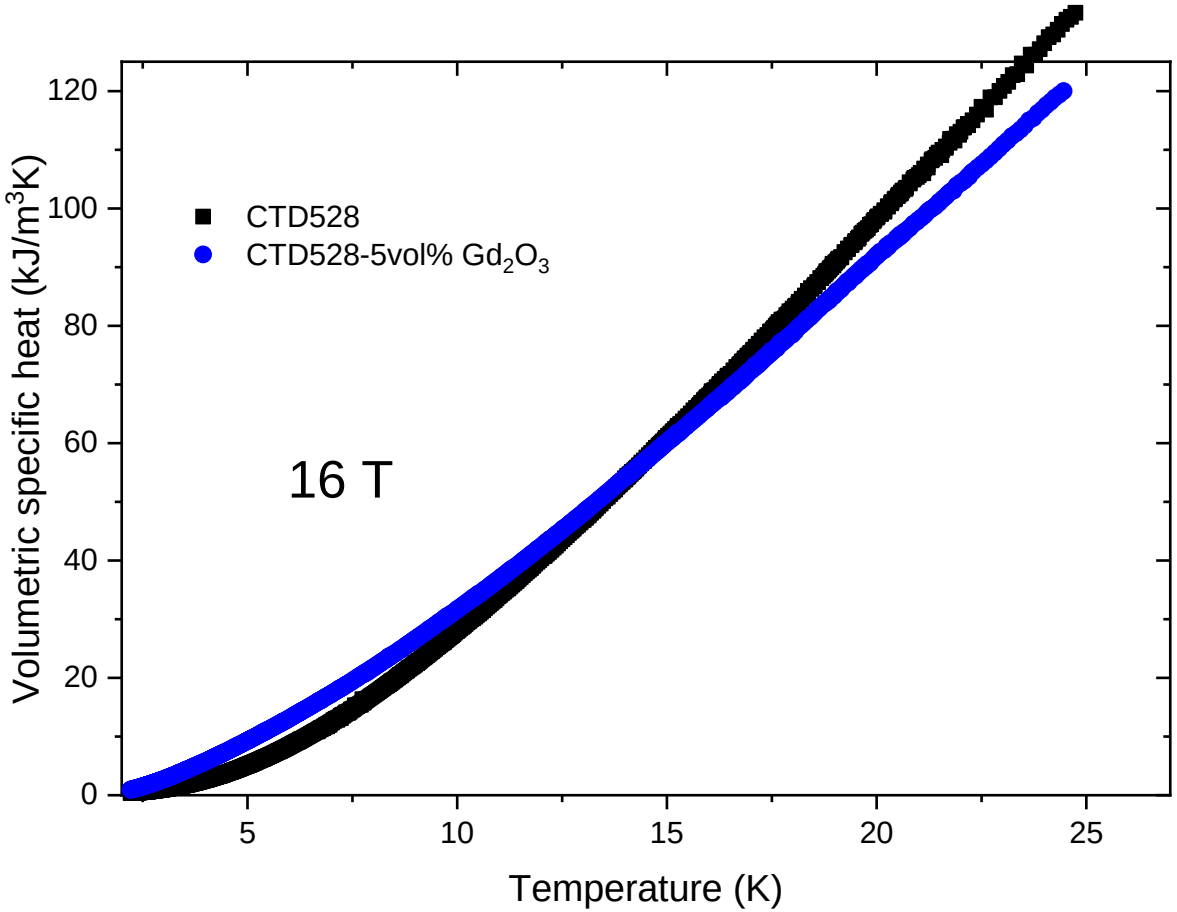
Very low temperature increase (not observed by Hill)

The peak is at 4.8 K, about 1 K higher in temperature that previous Gd_2O_3 data from Hill

Also the shoulder is shifted. It is here at about 3.5 K (1.5 K in Hill's paper)

Comparison with and without Gd_2O_3

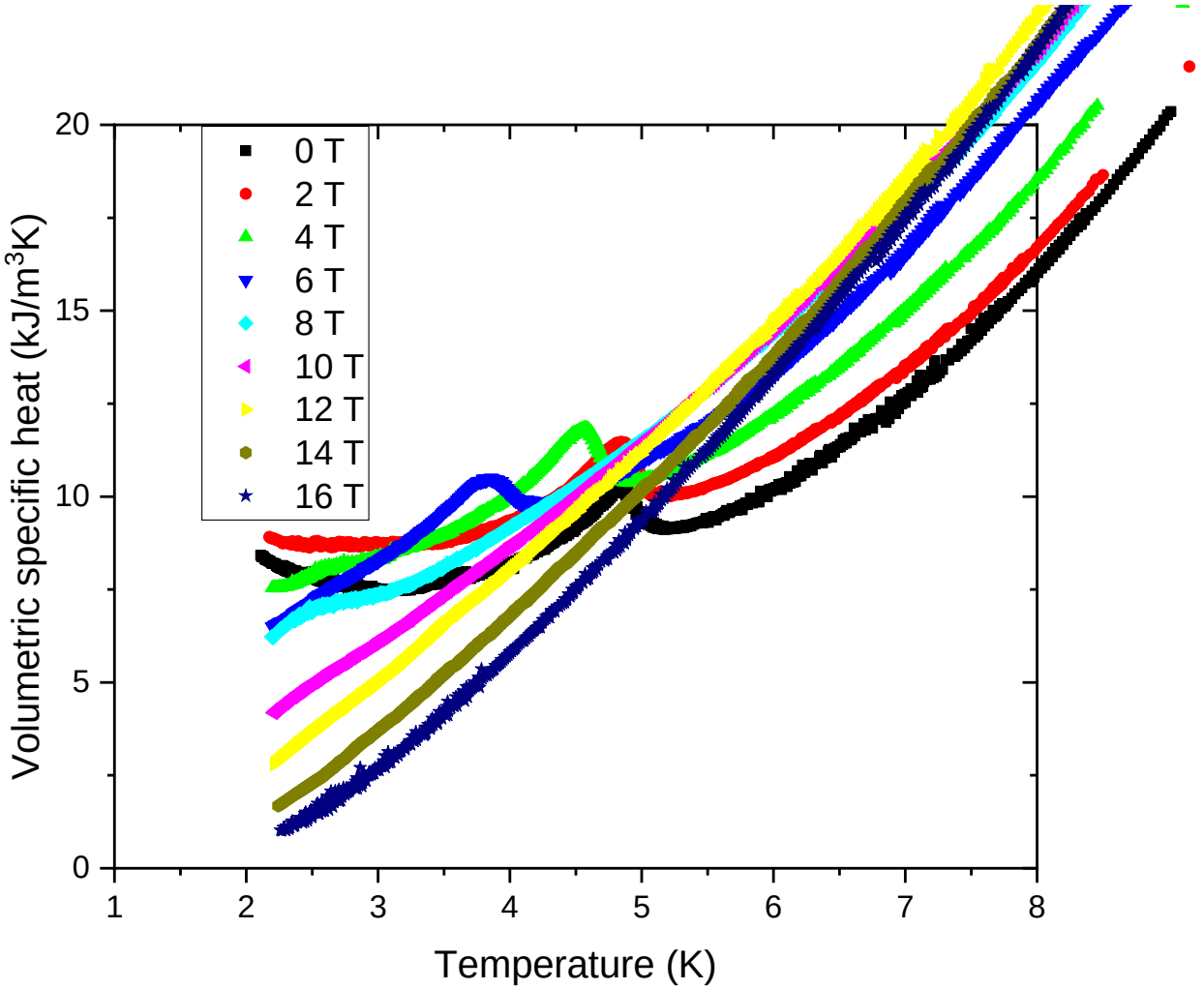


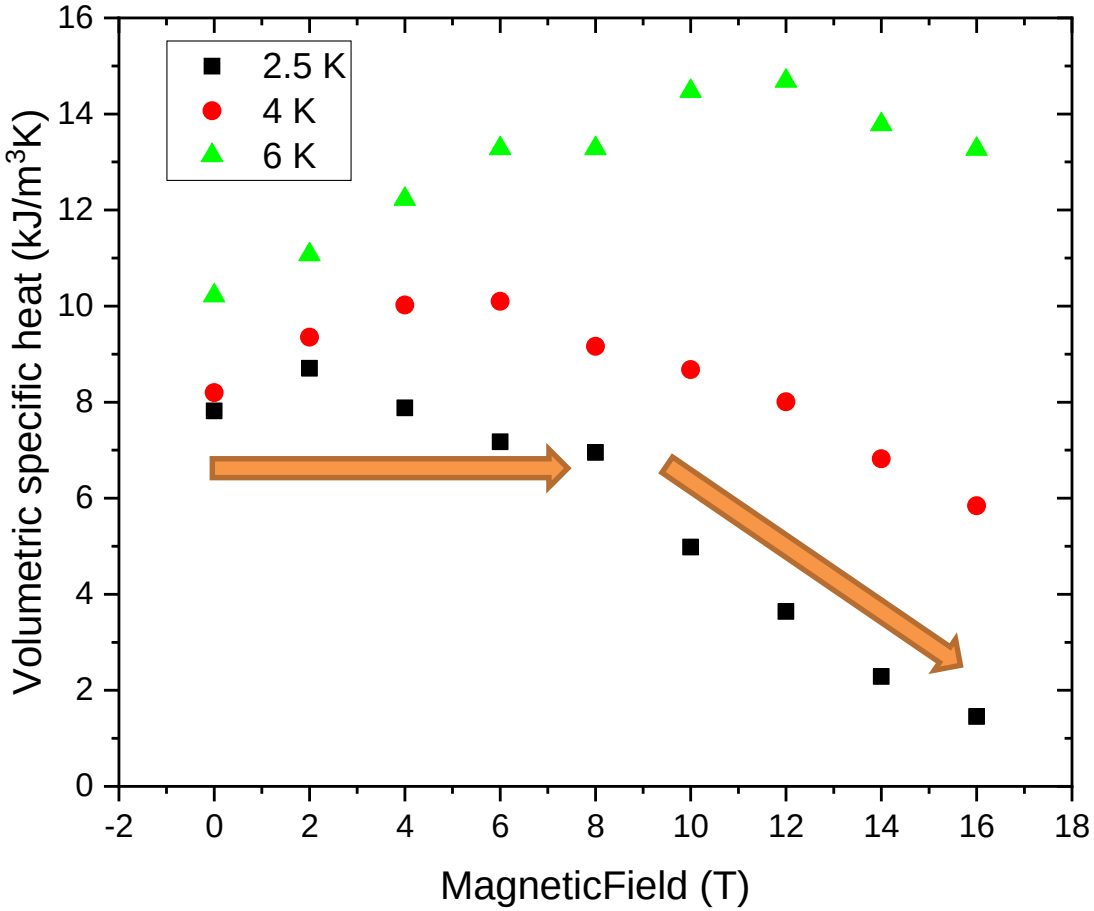


- *At 16 T, the epoxy with Gd_2O_3 still has high specific heat at low temperature despite the suppression induced by the field*
- *The heat capacity is lower at high temperature for the sample with Gd_2O_3*

New data on CTD528+5%vol Gd_2O_3 including intermediate fields

Strong field dependence in particular above 8 T





The suppression is particularly obvious above 8 T at the low temperature

Conclusions

- *These results show that the positive effect of Gd oxide significantly changes with applied field, in particular for field larger than 8 T.*
- *Gd_2O_3 might still be useful for the low field behavior - suppressing flux-jump - but the effect at 16 T is limited*
  - *At the lowest temperature is only a 2.6 times better than the sample without oxide at 16 T (against almost 28 times at 0T)*
- *At high temperature the specific heat of the epoxy with Gd_2O_3 is slightly lower than without*
  - *This could be beneficial because it increases the thermal diffusion*

Specific heat measurements on Cu+Gd_2O_3 wire

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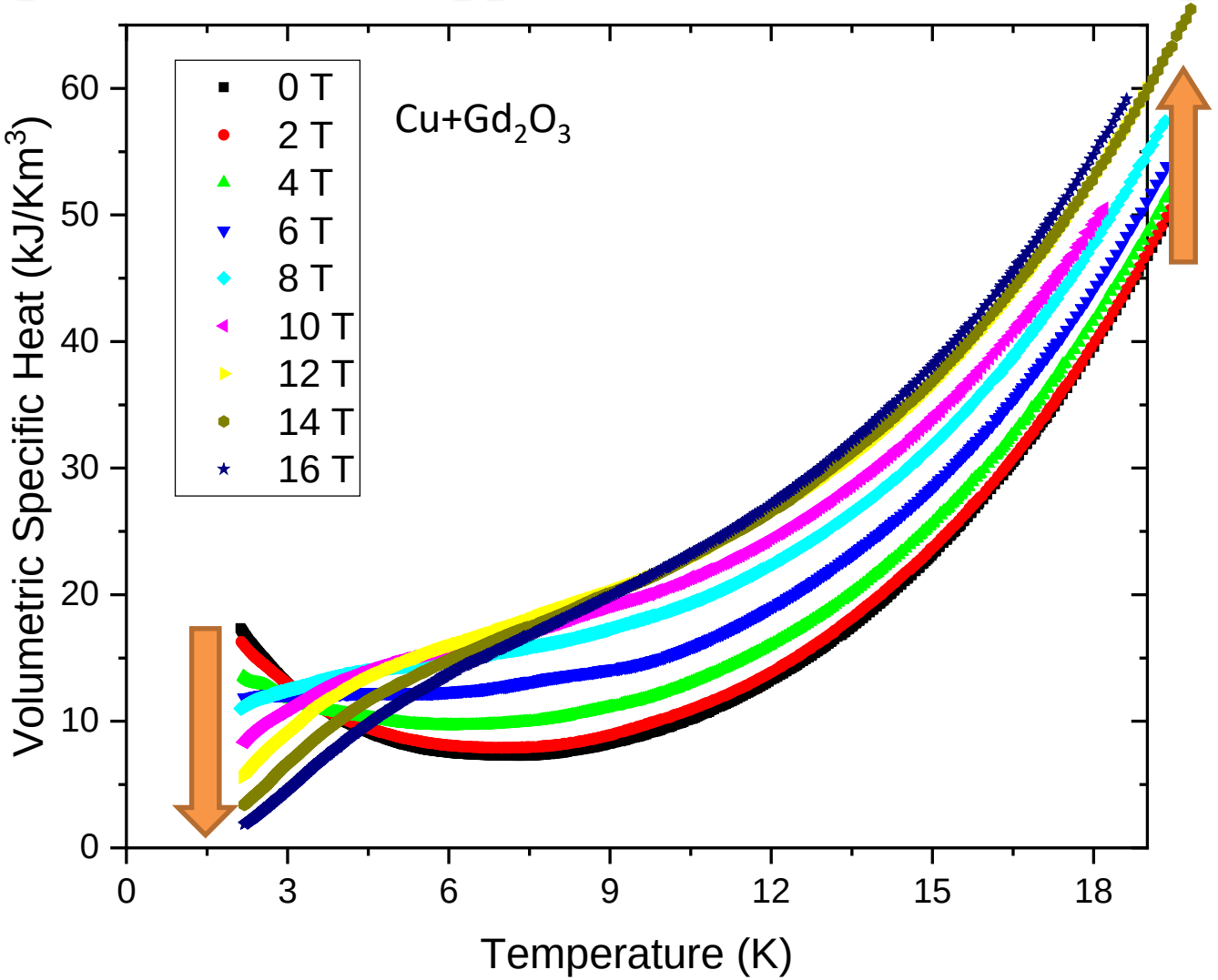
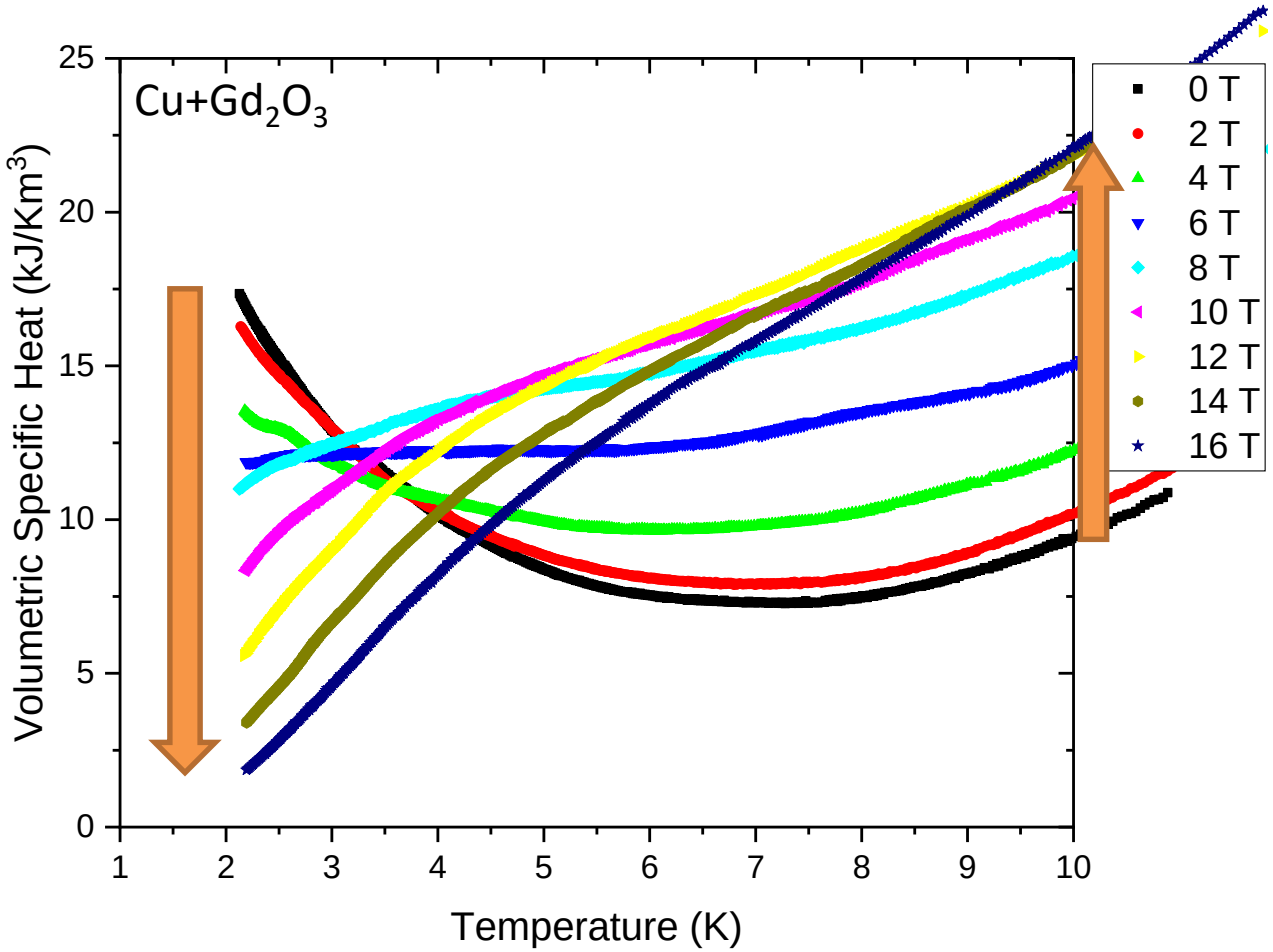
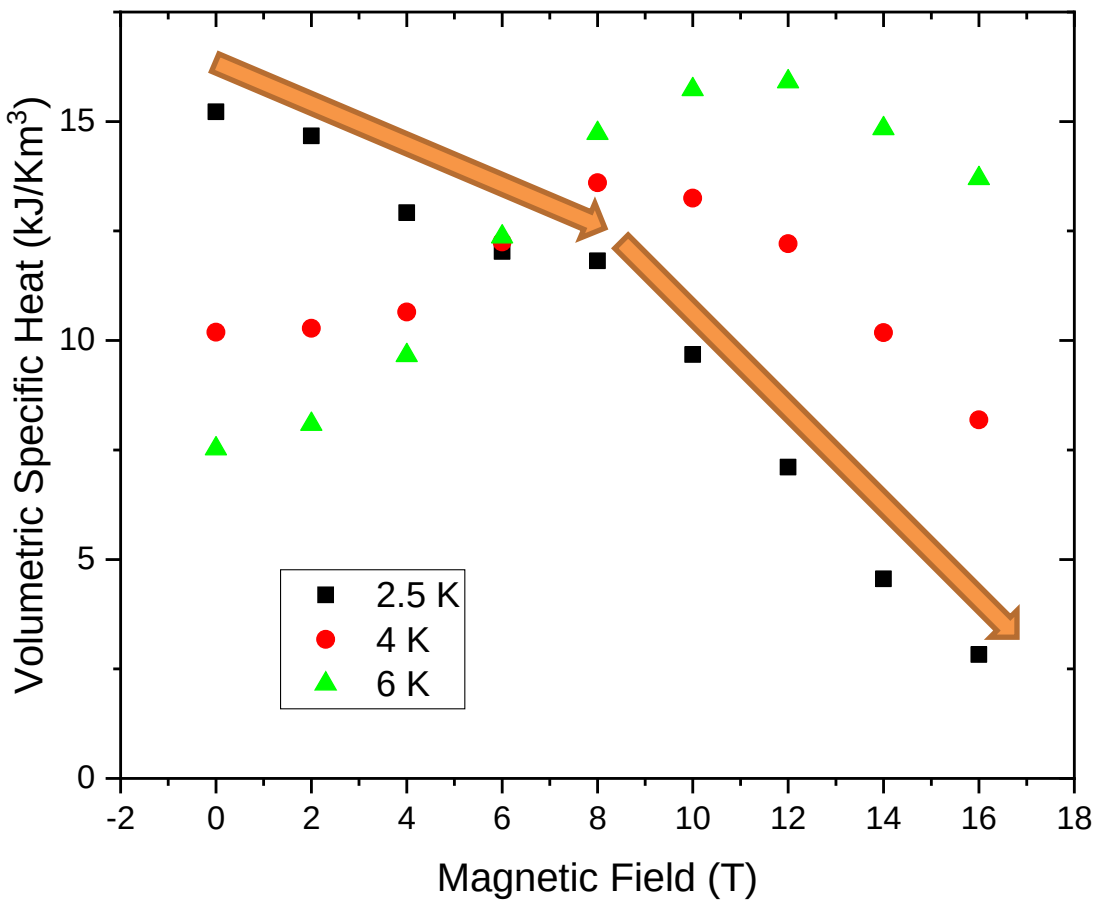
Strong field dependence with opposite trend at low and high temperature



- At low temperature the specific heat is strongly suppressed with increasing field
- At higher temperature (~18-20K) the specific heat clearly increases

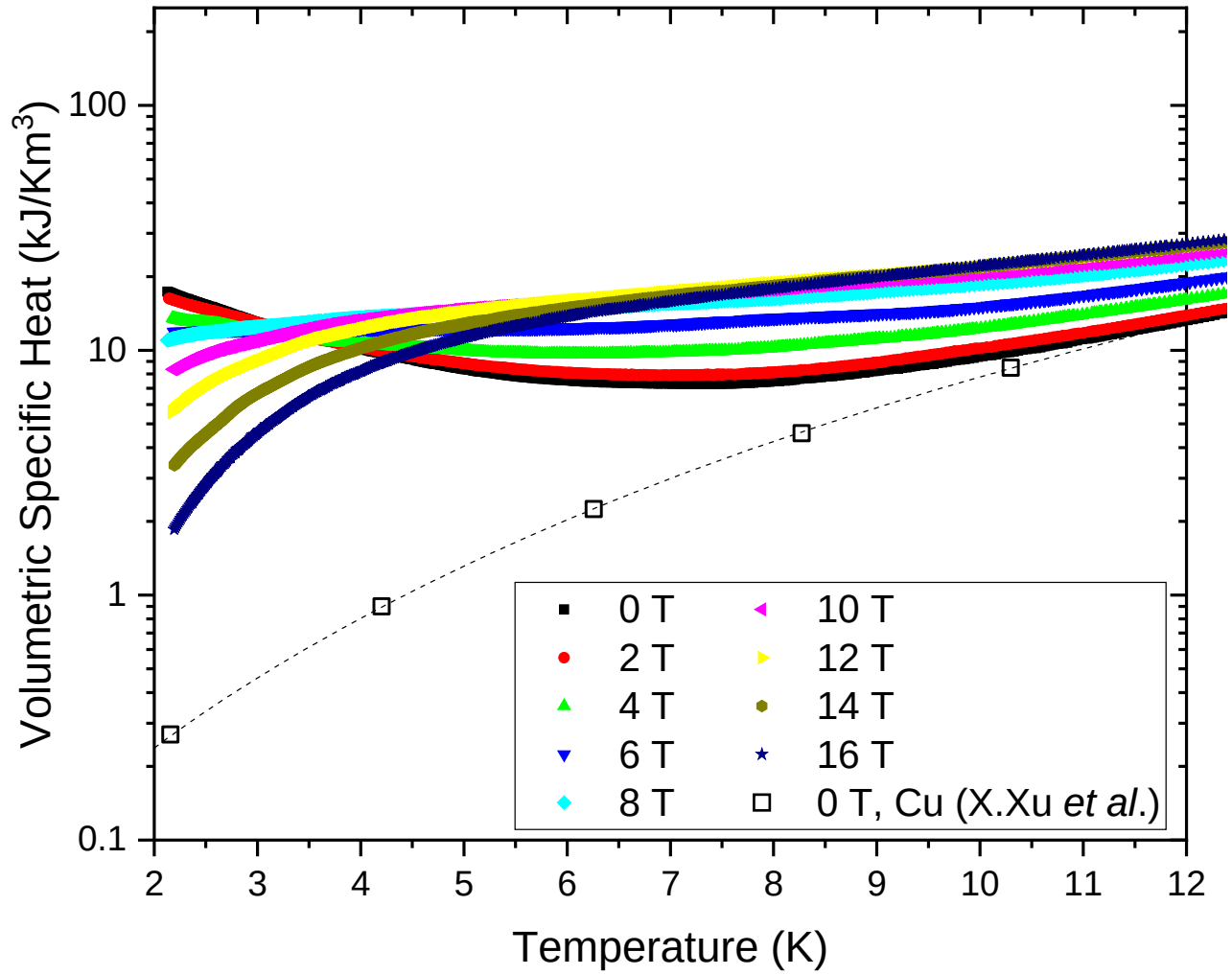
At low T, stronger field dependence above 8 T

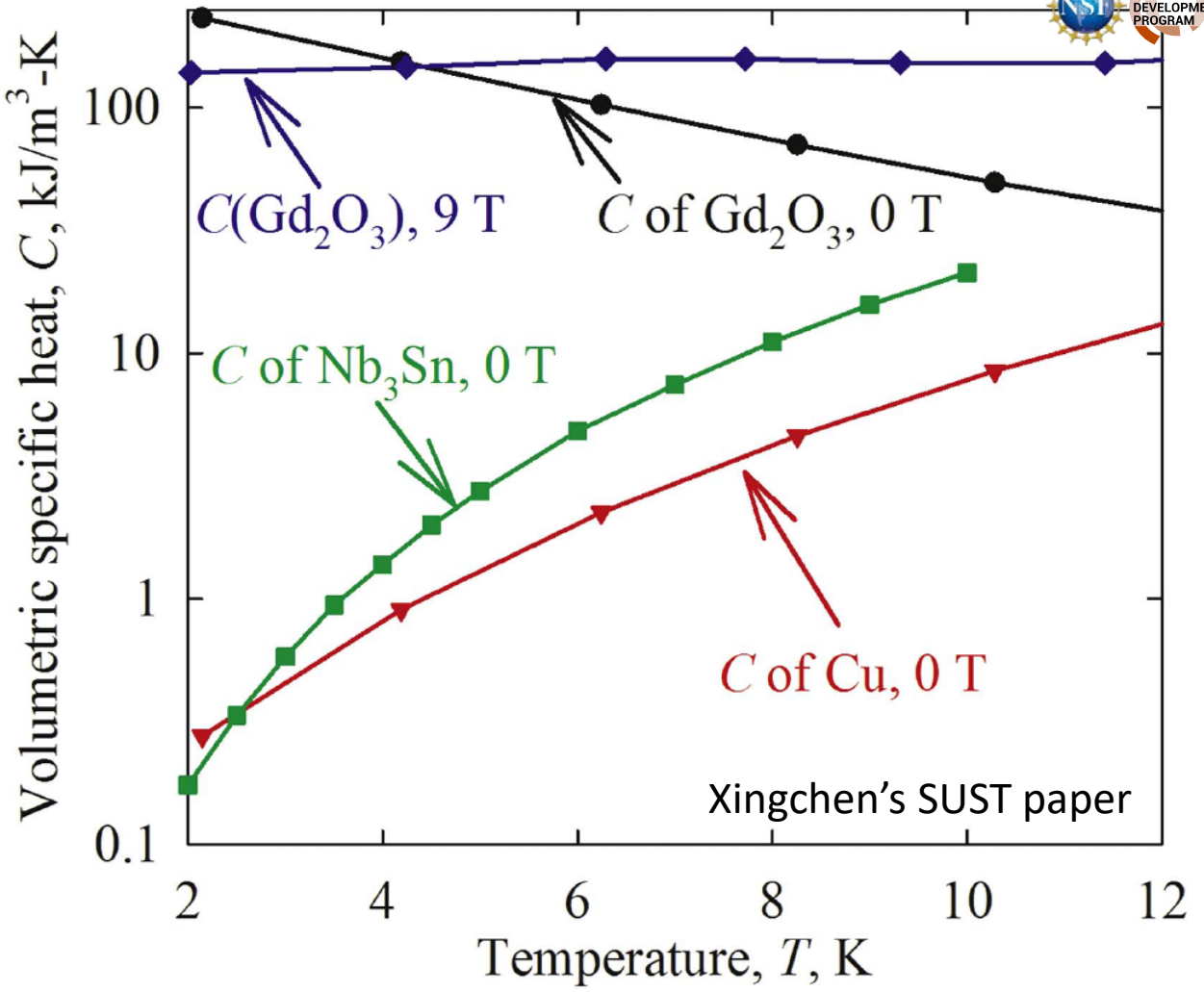




- *At the lowest temperature the specific heat always decreases with increasing field in particular above 8 T*

Comparing with Xingchen's previous data: at low temperature still better than Cu





- *At low temperature specific heat of Cu+Gd_2O_3 is still larger than Cu*
- *At larger temperature the in-field specific heat of Cu+Gd_2O_3 becomes larger than for Cu (no significant difference at 0 T, but more than a factor 2 larger at 12 K and 16 T).*

Conclusions

- *The specific heat of Cu+Gd_2O_3 is strongly field dependent with opposite behavior at low and high temperature*
- *Despite the clear suppression, the specific heat of Cu+Gd_2O_3 at low temperature is still larger than Cu*
  - *Potentially good for stabilization*
- *At larger temperature the in-field specific heat of Cu+Gd_2O_3 becomes larger than for Cu (more than 2X at 12 K and 16 T)*
  - *The implication from the quench protection point of view should be evaluated*
  - *The largest the specific heat, the smallest the thermal diffusion*