

# Burstlike first-order transformation studied by semi-adiabatic relaxation calorimetry

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This Supplementary section contains

1/ Estimate of the shift between  $T_p$  and  $T_s$  within the transitional regime

2/ Estimate of the entropy step at the transition from the Clausius-Clapeyron equation

## 1/ Estimate of the shift between $T_p$ and $T_s$ within the transitional regime

From Eqs. 2(a) and (A2), one derives

$$T_s(t) = \frac{K_g T_p(t) + 4S\sigma_T \varepsilon_s T_b^4 - P_L(t)}{K_g + 4S\sigma_T \varepsilon_s T_b^3} \quad (\text{SM1})$$

Considering the smallness of the radiative corrections, one can use the approximation  $T_s(t) \approx T_p(t) - [P_L(t)/K_g]$ , where  $K_g$  is the thermal conductance of the layer of grease at the temperature of the transition. It turns out that this parameter can be evaluated from the standard two- $\tau$  analysis performed outside the region of the FOT. In this case, the  $T_p(t)$  profiles are fitted to a double-exponential expression yielding the time constants  $\tau_1$  and  $\tau_2$  ( $\ll \tau_1$ ).

Within the framework of the Hwang *et al.* model [1] (whose main results are summarized in [2]),  $K_g$  can be derived from  $\tau_1$  and  $\tau_2$ , combined with the values of  $C_{ad}$  and  $K_w$  obtained in the background measurement (platform +grease) recorded prior to that of the sample:

$$K_g = \frac{C_{ad}}{\tau_1 \tau_2} \left[ (\tau_1 + \tau_2) - \frac{C_{ad}}{K_w} \right] - K_w \quad (\text{SM2})$$

Figure SM1 shows the temperature dependence of  $K_g$  (T) derived in this way. Obviously, the anomaly located close to the FOT temperature in Fig. SM1 is out of the range of validity of this approach. In practice, a reasonable estimate of  $K_g$  at  $T_{tr}$  can be easily estimated by extrapolations from each side of the transitional regime. Doing so, one found  $K_g \sim 735 \mu\text{W/K}$ .

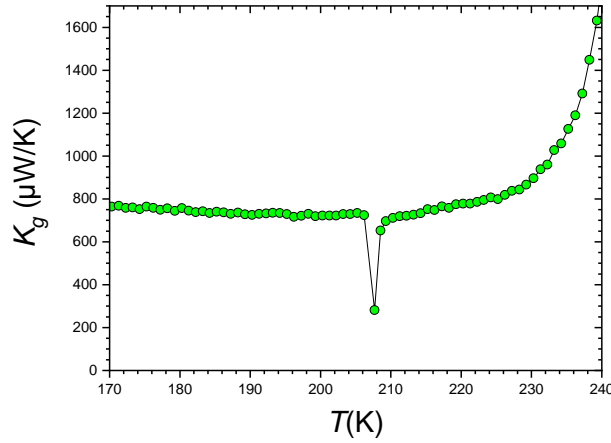


Fig SM1: Thermal conductance of the layer of grease at the interface sample/platform, derived from Eq. (SM2).

Let us emphasize the steep increase in  $K_g$  when approaching 240 K, which is an intrinsic property of Apiezon N (glass transition) [3]. The typical value of  $K_g$  for a same layer of grease is increased by a factor of about 50 around room temperature. It is clear that below 240 K (as it is the case in the present experiment) the rather poor  $K_g$  value induces a considerable time lag which is not favorable to investigate the dynamical features of the transition.

## 2/ Estimate of the entropy step at the transition from the Clausius-Clapeyron equation

The entropy step ( $\Delta S_{tr}$ ) at the temperature  $T_{tr}$  of the FOT can be derived from the Clausius-Clapeyron equation. A series of  $M(B)$  curves has been recorded in the range 0-2 T (Fig. SM2).

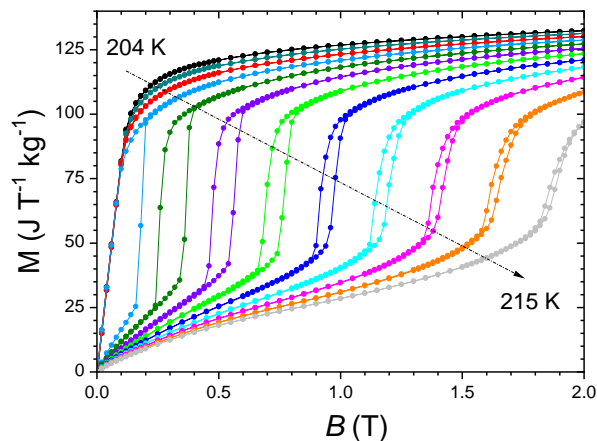


Fig SM2: Series of  $M(H)$  curves at selected temperatures.

Considering either the ascending or decreasing branches, the field of transition can be easily derived from the midpoint of the transition. This yields two lines of transition that we choose

to present as  $T_{tr}(B)$  (see Fig. SM3). One observes that the hysteresis decreases as the field is increased, which is an usual feature for these compounds [4].

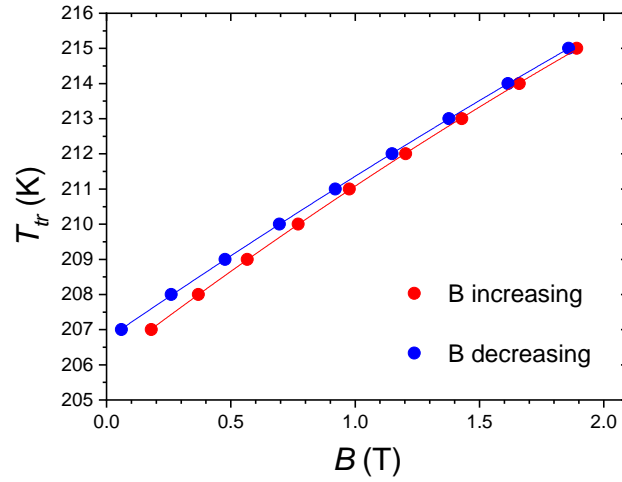


Fig SM3: Field dependence of the transition temperature. The line are fittings by second-order polynomial functions.

The estimate of the magnetization step at the transition is more delicate, since it necessarily involves a somewhat subjective criterion. In our case, we derived these  $\Delta M$  values from constructions such as the two examples displayed in Fig. SM4: linear extrapolations lying on the last couple of data points on each side of the transition are drawn; then, the  $\Delta M$  is evaluated from the crossing points between these extrapolations and a vertical line located at  $T_{tr}$ .

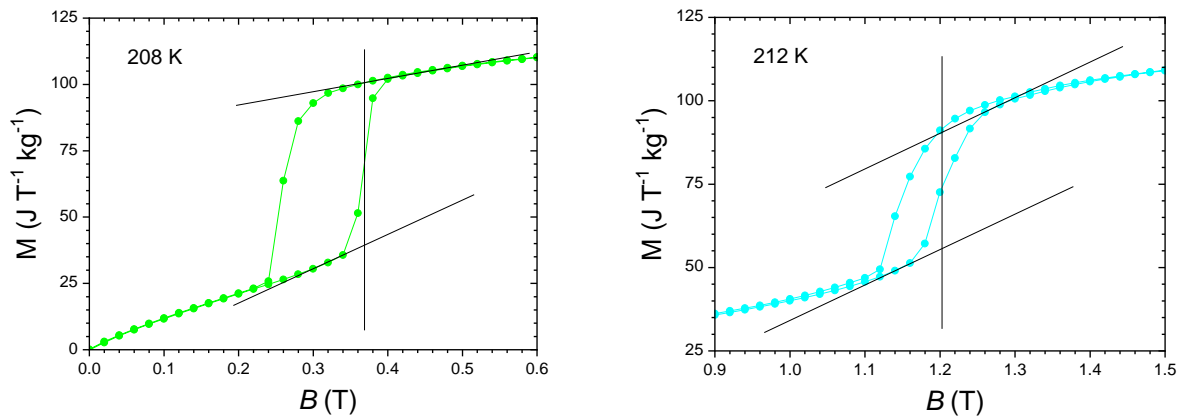


Fig SM4: Examples of construction used to estimate  $\Delta M$  (ascending branches)

The  $\Delta S_{tr}$  are then obtained from the equation

$$\Delta S_{tr} = - \frac{\Delta M}{(dT_{tr}/dB)} \quad , \quad (\text{SM3})$$

in which  $dT_{tr}/dB$  is derived from the second-order fittings to the  $T_{tr}(B)$  lines.

Figure SM5 shows the results considering either the ascending or descending branches of the  $M(H)$  curves.

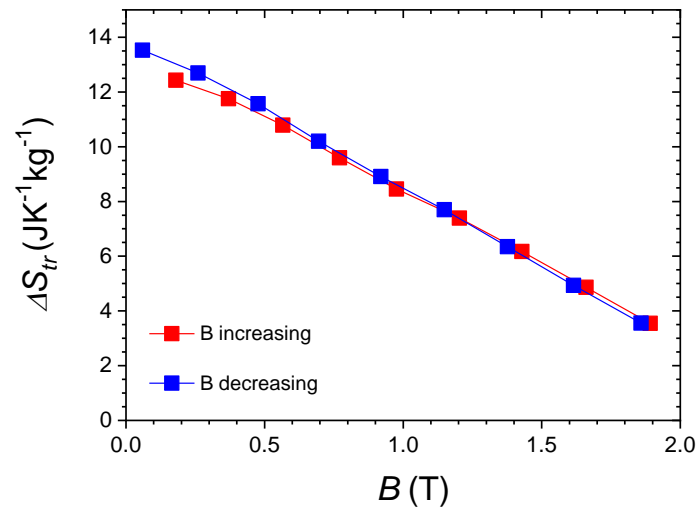


Fig SM5: Field dependence of the entropy jump at the FOT.

## REFERENCES

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