



## TOPIC: The Heat Capacity of the Addenda is a Function of Magnetic Field Below 10 Kelvin

**CONFIGURATION:** The following effect can be observed with any Quantum Design Heat Capacity puck or platform when used in a magnetic field. The effect is independent of software version.

**DESCRIPTION OF PROBLEM:** Inaccurate heat capacity measurements can result if one assumes that the heat capacity of the addenda is independent of magnetic field. In fact, the heat capacity of the sample platform depends on magnetic field below about 10 K and above about 0.5 T. The effect appears to be a result of magnetic impurities in the construction materials of the alumina sample platform. The field dependence appears to be that of a Schottky Effect where there is a magnetic heat capacity peak superposed on a field independent heat capacity versus temperature curve. The peak shifts to higher temperatures with applied magnetic field. At zero field, the peak exists around 0.5 K, resulting in a minimum in the heat capacity near 1K.

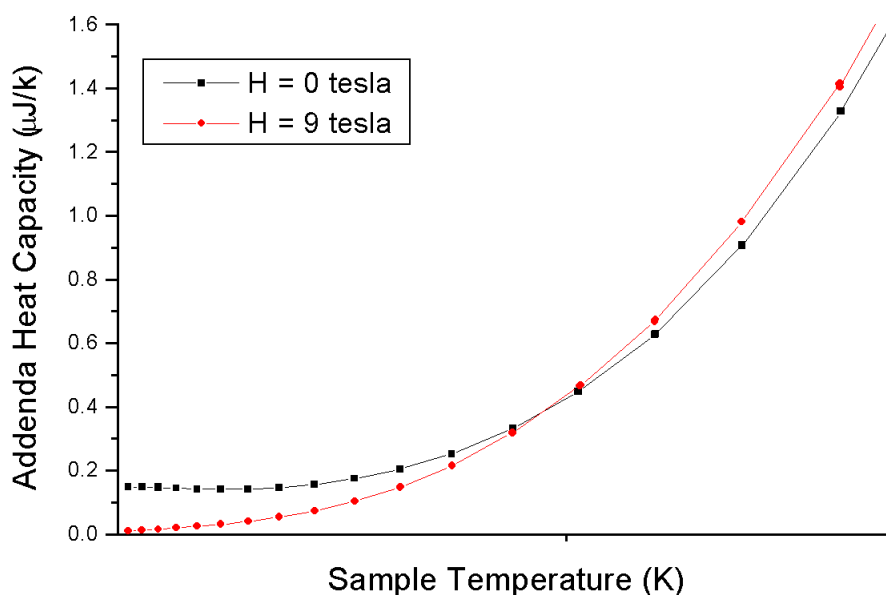


Figure 1: Addenda heat capacity measurement at 0 and 9 tesla. In both cases, the platform thermometer has been corrected for magneto-resistance errors.

It is important to point out that this effect is completely independent of the magneto-resistance errors associated with the resistive thermometer used on the platform. The results presented here assume that the magneto-resistance errors associated with the thermometer have been corrected, or are negligible. Please consult the latest Heat Capacity User's manual for specific instructions on calibrating the heat capacity thermometer for use in a magnetic field.

The Schottky Effect is not a heat capacity error, rather it is a heat capacity that depends on magnetic field. The effect will only be a problem to the extent that you depend on accurate subtraction of the addenda. If your sample has a much larger heat capacity than the addenda, or if you are specifically interested in locations of transitions, or relative changes in heat capacity between samples, this effect may not be a problem.

**SOLUTION:** Below about 10 K, acquire addenda measurements to create different addenda tables at the specific magnetic field(s) of interest before mounting your sample. Then during the measurement of your sample, select the appropriate addenda table corresponding to the applied magnetic field.