



Contribution ID: 296

Type: **Contributed Oral**

C4Or1A-06: Characterization of single-crystal GdLiF₄ entropy

Thursday 22 May 2025 10:45 (15 minutes)

Gadolinium lithium fluoride (GLF) is an attractive material for Adiabatic Demagnetization Refrigerators (ADRs) because it has a high density of active ions and a relatively low effective ordering temperature. We have encapsulated a large GLF crystal in a thermal bus, integrated it into an ADR, and have characterized this salt pill through operation of the ADR. From these measurements, we are able to extract the entropy of single-crystal GLF as a function of temperature and field. Measurements at zero field with different heat loads applied allow us to characterize the parasitic heat load, as well as the zero-field heat capacity. This agrees with the results of Numazawa [1] for polycrystalline GLF. Isothermal demagnetization measurements with different heat loads allow us to extrapolate to the zero heat flow (reversible) entropy as a function of field. They also allow us to determine the degradation of entropy capacity with increasing heat flow into the pill. We have developed a relatively simple functional form, derived from the independent-ion approximation, that fits the entropy well with several free parameters.

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Session Classification: C4Or1A - Adiabatic Demagnetization Refrigerators