BRIEFING CHART

NASA SBIR/STTR Technologies

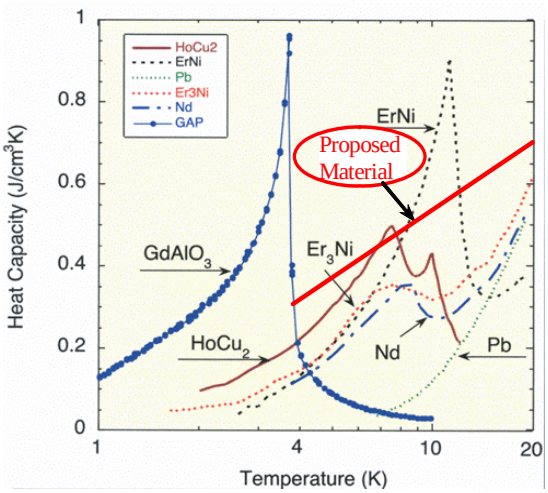
Highly Effective Thermal Regenerator for Low Temperature Cryocoolers

PI: Dr. Weibo Chen/Creare Incorporated, Hanover, NH

Proposal No.: 05-1 S4.03-9774

Identification and Significance of Innovation

- Innovative non-rare-earth regenerator matrix material
  - Utilize the high heat capacity of the proposed non-rare-earth composite material to significantly increase the thermal capacity of low temperature regenerators.
  - The non-rare-earth matrix material can be more easily shaped into the forms needed for optimal regenerator performance than rare-earth compounds.
- Benefits
  - Enable the use of low temperature detectors and mirrors (<15 K) for NASA space telescopes.
  - Improve the efficiency of low temperature regenerative cryocoolers.
  - Reduce the cost and mass for regenerative cryocoolers.
- The proposed material provides high heat capacity over a broad range of temperatures less than 15 K.



Comparison of the Proposed Material Heat Capacity with Rare-Earth Compounds

Technical Objectives

- Increase the volumetric specific heat of regenerators to improve the efficiency of low temperature cryocoolers.
- Improve the thermal performance of the non-rare-earth regenerator by taking full advantage of the fabricability of the proposed material.

Work Plan

- Determine the optimal non-rare-earth matrix material.
- Select optimal configuration for the Helium Adsorbent Regenerator and perform trade-off study to determine optimal parameters
- Assess the performance of the proposed regenerator in a low temperature regenerative cryocooler.

NASA Applications

- Cooling systems for high performance low-temperature detector arrays and mirrors to increase sensitivity and reduce thermal noise.

Non-NASA Applications

- Military applications
  - Space surveillance, and missile targeting and tracking systems.
- Commercial applications
  - Superconducting magnets.
  - Low-temperature SQUIDs for medical use.
  - High-performance superconducting digital technology.