Elastocaloric Refrigeration for Spaceflight Applications (ERSA)

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Topic 3 – Advancing the Performance of Refrigeration Systems Based on the Elastocaloric Effect

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Research Objectives

To accomplish:

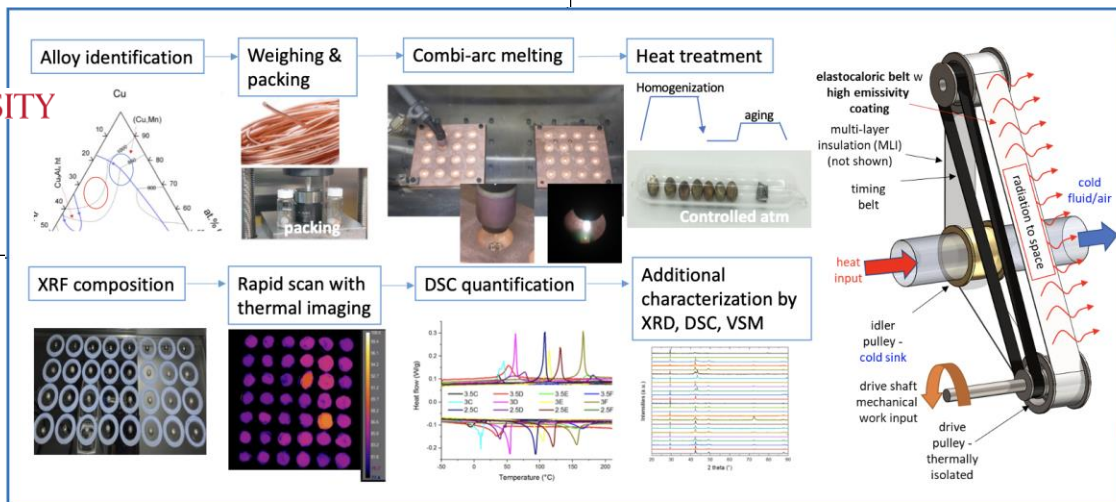
- Identify new elastocaloric materials suitable for spaceflight refrigeration application
- Design elastocaloric space radiator and demonstrate key components
- Identify other suitable spaceflight applications

Innovation:

- High throughput mat's development methodology
- On-demand passive/active hybrid cooling

Compare to SOA:

- More powerful, reliable materials
- Robust space radiator
- TRL: 1 ⇨ 3



Approach:

Elastocaloric Materials:

- DFT calculation and prediction of latent heat
- High throughput materials synthesis & screening
- Machine learning data analysis and prediction
- Conventional alloy synthesis & characterization for validation and scaleup
- Validation in an elastocaloric test-bed

Elastocaloric Radiator:

- Explore spaceflight applications and define system specification
- Conceptual system design (SOLIDWORK)
- Component demonstration

Potential Impact

Benefits to future space science & exploration

An efficient and safe elastocaloric refrigeration technology will benefit several spaceflight applications such as life support, crew health/performance, geological/biological sample preservations, cryogenic fluid management, instrument thermal management and thermal control system radiator

Other benefits and outcomes:

- Establish a methodology effective for developing a wide range of metals and ceramics.
- Add a large data set to NASA's Shape Memory Materials Database