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Apparatus and method for low-temperature training of shape memory alloys

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An apparatus and method for the low-temperature mechanical training of shape memory alloys has been developed. The shape memory alloy (SMA) materials are prototypes being developed for novel thermal management systems in future cryogenic applications. Alloys providing two-way actuation at cryogenic temperatures are the chief target. The mechanical training regime was focused on the controlled movement of rectangular strips, with S-bend configurations, at temperatures as low as 30 K. The custom holding fixture included temperature sensors and a low heat-leak linear actuator with a magnetic coupling. The fixture was mounted to a Gifford-McMahon cryocooler providing up to 35 W of cooling power at 20 K and housed within a custom vacuum chamber. Operations included both training cycles and verification of shape memory movement. The system design and operation are discussed. Results of the training for select prototype alloys are presented.

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