OAK RIDGE NATIONAL LABORATORY
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Functionalized Fe-Based Shape-Memory Alloys for Advanced Magnetocaloric Refrigeration Systems

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Technology Summary

The structural and magnetic properties of earth-abundant Fe-based shape-memory alloys (SMA) indicate that the material shows strong indications of a potential for very strong magnetocaloric effect (MCE), however these recently discovered alloys have not been evaluated for such applications. The present invention involves a novel processing method that functionalizes Fe-based shape memory alloys for MCE applications. Additionally, the application of materials of these compositions in MCE applications is a novel concept that is not obvious to those skilled in MCE materials. Other Fe-based materials have been examined for MCE applications, however this has not been successful due to a high curie temperature and a wide hysteresis. The present invention involves a unique selection of alloy composition and special treatment that mitigates these deleterious effects by lowering the Curie temperature to near room temperature and narrowing the hysteresis. Advanced alloys based on earth abundant non-toxic materials are needed to meet the demands of commercial HVACR systems. Refrigeration systems based on the magnetocaloric effect have the potential for improvements of 60-100% in performance over conventional gas compression systems.

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