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Predicting giant caloric effects in selected magnetic and shape-memory alloys.[1] NIKOLAI ZARKEVICH, DURGA PAUDYAL, DUANE JOHNSON, Ames Laboratory, CALORICOOL TEAM[2] — We investigate giant caloric effect in selected classes of materials, detailing entropy contributions during phase transformations. Our target material is environmentally friendly and commercially viable with a reversible transformation having a small hysteresis and a large temperature change ΔT at practical applied fields. Given that hysteresis widths increase with height of enthalpy barriers, and that large entropy change at a finite heat capacity yields a large ΔT during the phase change, we may screen for promising candidates for caloric heating or cooling. FeRh is a showcase for caloric materials genome, transforming upon heating from type-2 antiferromagnet (AFM) to ferromagnet (FM). Its AFM (but not FM) B2 lattice has instabilities, which enlarge the entropy. Detailing caloric origin provides guidance to predict new materials and tune properties, as with doped Fe-Mn, $LaFe_{13}$, and Ni-Ti, for optimal performance in practical applications.

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[2]Caloric Materials Consortium established within the U.S. Department of Energy (DOE) Energy Materials Network.

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