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MAKING A COOL CHOICE: THE MATERIALS LIBRARY OF MAGNETIC REFRIGERATION

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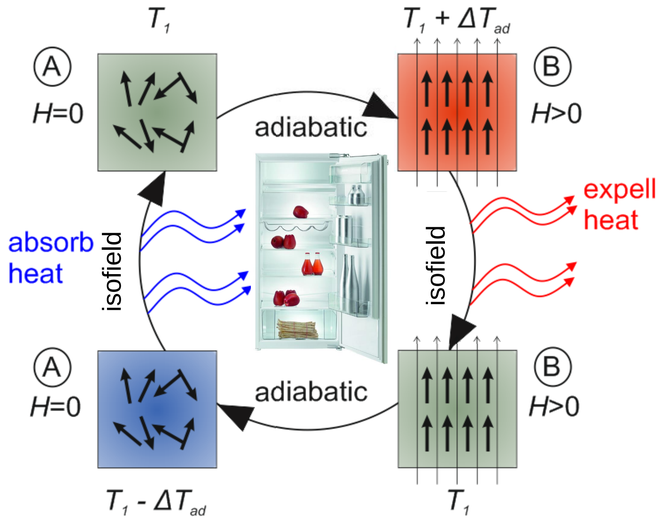
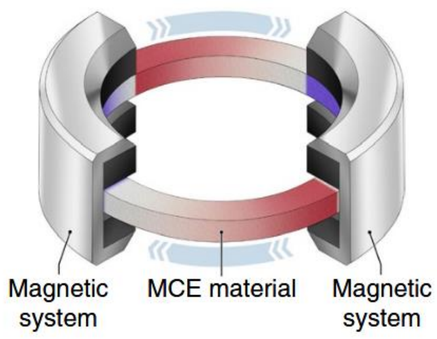
Magnetic refrigeration – from material science to application

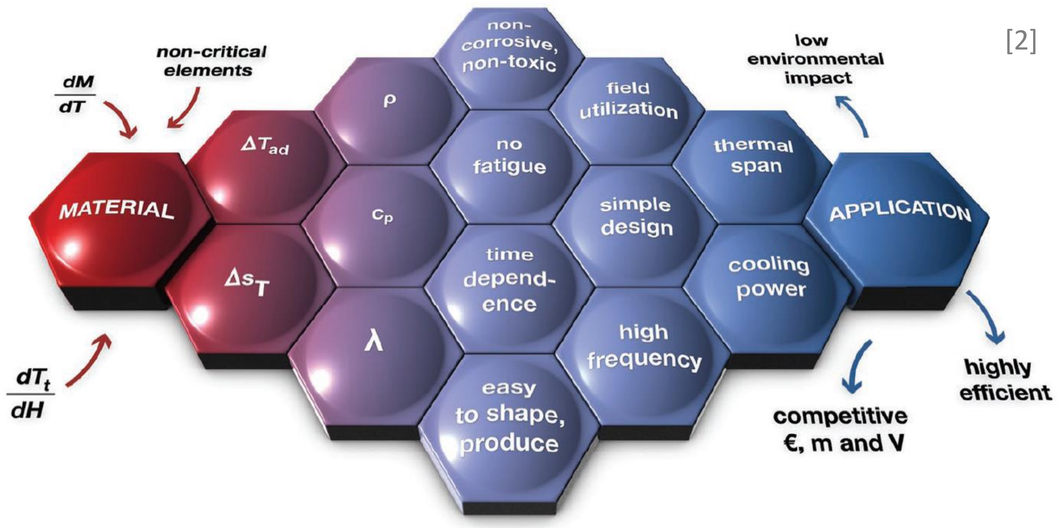
Magnetic refrigeration cycle



[1]

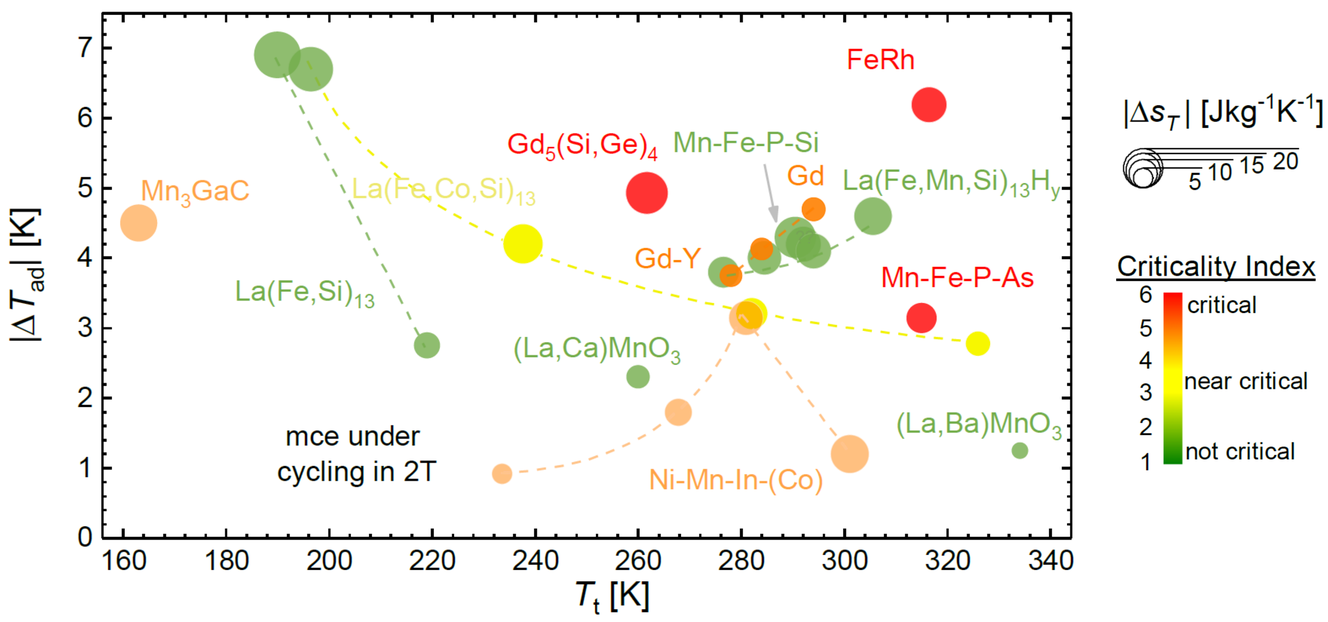


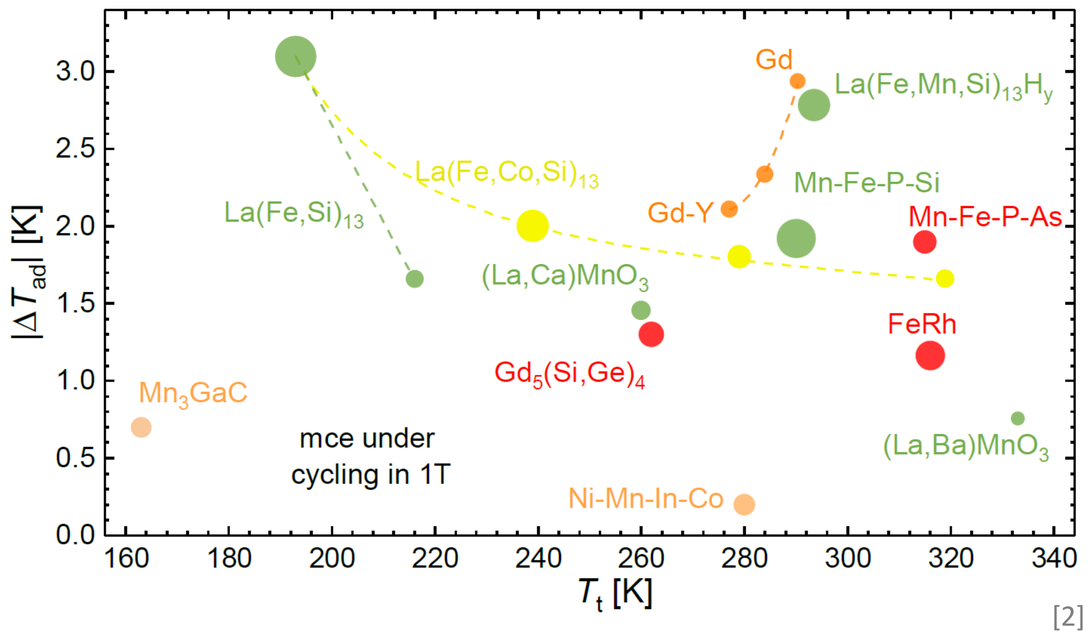
Roadmap for magnetic refrigeration



[2]

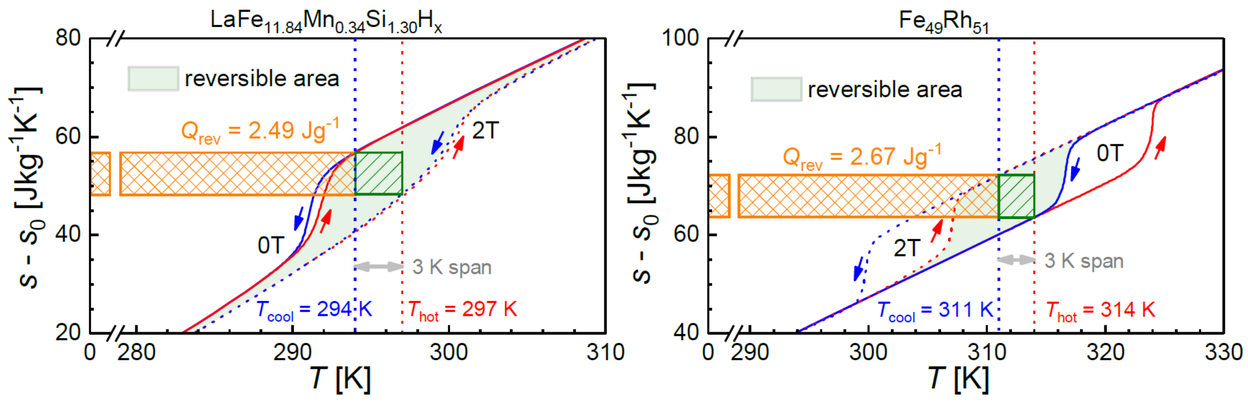
Reversible magnetocaloric effect and criticality – overview about materials



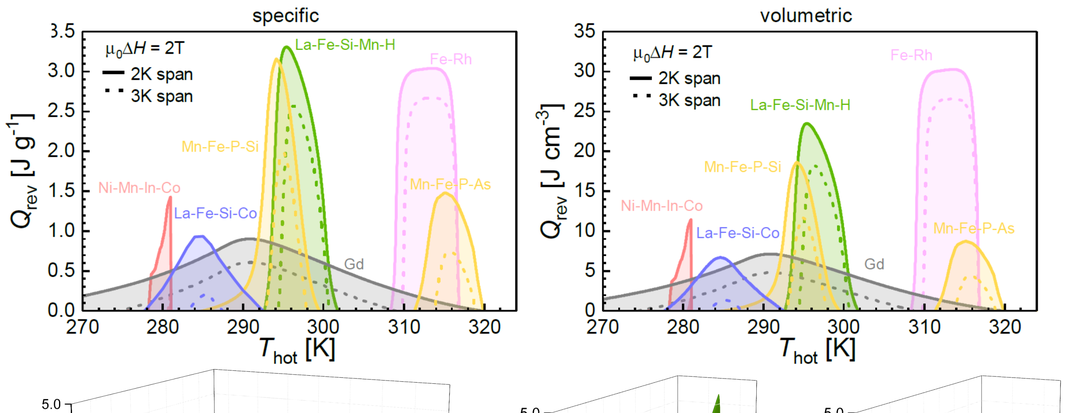


[2]

Reversible transferable heat as figure of merit Q_{rev}



[2]



Conclusions

- High-quality stacks of first-order materials are essential for large T_{span}
- Performance of alternatives to Gd become better with increasing magnetic field >1 T
- Further improvement of known materials and reduction of hysteresis are essential to outperform Gd
- FeRh is the best material regarding Q_{rev} but most critical, LaFeSiCo similar Q_{rev} than Gd
- Alternative concepts like mulitcaloric [3] or multi-stimuli [1] cooling which exploit thermal hysteresis can be an option to reduce the quantity of permanent magnets and increase the efficiency.

References & acknowledgments

[1] T. Gottschall et al., Nat. Mater. 2018, 17, 929
[2] T. Gottschall et al., Adv. Energy Mater. 2019, 1901322
[3] X. Moya et al., Nat. Mater. 2014, 13, 439

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