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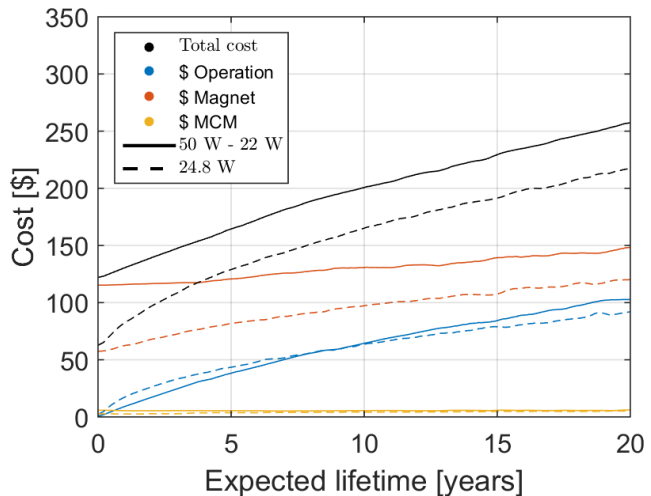
The Total Lifetime Cost of a Magnetic Refrigerator

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In this work we consider the total cost of a 25 W average load magnetic refrigerator using commercial grade Gd and a temperature span of 30 K. The price of magnetocaloric material, magnet material and cost of operation are considered. All these effects influence the total cost. Two devices are considered, one which operates at 24.8 W continuously and one which operates at 50 W for 10% of the time and 22W at 90% of the time.

Using a numerical model we calculate the lowest combined total cost of a device with a lifetime of 15 years and find this to be in the range \$150-\$400, depending on the price of the magnetocaloric and magnet material and with the cost being lowest for the 24.8 W continuously operating device. The optimal device parameters are also determined: the optimal magnetic field is about 1.4 T, the particle size is 0.23 mm, the length of the regenerator is 40-50 mm and the utilization is about 0.2, for all device lifetimes and material and magnet prices, while the operating frequency vary as function of device lifetime. The considered performance characteristics are based on the performance of a conventional A⁺⁺⁺ refrigeration unit. In a rough life time cost comparison under the above given assumptions between the AMR device and such a conventional unit we find similar costs, the AMR being slightly cheaper, assuming the cost of the magnet can be recuperated at end of life.



Key Words: Magnetic refrigerator; Cost; Price; Compressor

References R. Bjørk et. al. Submitted to Int. J. Refrig, 2015.