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Simulation of Magnet Design for Magnetic Refrigeration

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Magnetic refrigeration is a new technology based on the reduction of temperature below the room temperature by magnetocaloric effect. The Comsol mutiphysics and Poisson Superfish program are used to simulate the optimum structure for generating the maximum magnetic flux density in the air gap. A neodymium-iron-boron permanent magnets has a remanent flux density of 1.44 Tesla and relative permeability of 1.05. A soft magnetic material is low-carbon steel for conducting and directing magnetic flux. The magnetic flux density in the air gap is dependent on 1) the area of the soft magnetic material 2) the radius of Halbach cylinder and 3) the magnetic flux density change in angular direction. From the simulation, the magnetic flux density in the 30 mm air gap between the soft magnetic materials is at the optimum when the area of soft magnetic materials us equal to the area of permanent magnet. With the magnetic flux density at the air gap is as high as 1.59 Tesla, this distance is appropriate to design a magnetic refrigerator.

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