

Neodymium Iron Boron Magnets

Neodymium iron boron magnets, also known as $\text{Nd}_2\text{Fe}_{14}\text{B}$ magnets, neodymium magnets, neo magnets, Nd-Fe-B magnets, $\text{RE}_2\text{TM}_{14}\text{B}$ magnets, or simply 2:14:1 magnets, were developed in the 1980s. $\text{Nd}_2\text{Fe}_{14}\text{B}$ has a tetragonal crystal structure. The heavy rare earth element, Dysprosium, is often added to increase intrinsic coercivity and maximum operating temperature. Small amounts of other transition metals, such as Al, Co, Cu, Nb and/or Ga, can be added to modify the microstructure to improve performance.

The key features of sintered Nd-Fe-B magnets include:

1. Highest room temperature maximum energy product, $(\text{BH})_{\text{max}}$, up to 52 MGOe;
2. Relatively less expensive;
3. Less brittle than SmCo magnets;

Some drawbacks include:

1. Surface coating, such as Ni plating, is needed to protect the magnets from corrosion;
2. Maximum operating temperature is lower as compared to Sm-Co magnets.

Although Nd-Fe-B magnets have a maximum energy product of more than 50 MGOe at room temperature, their maximum operating temperature is relative low due to low Curie temperature. If the operating temperature is a concern, you may want to consider Sm-Co magnets especially when the maximum operating temperature is more than 180 °C. Reversible temperature coefficient of residual induction of Nd-Fe-B magnets is around $-0.11\% / ^\circ\text{C}$, which is about three times as large as Sm-Co magnets.

In order to avoid corrosion, surface protection is required for Nd-Fe-B magnets. Ni plating, epoxy coating and aluminum ion vapor deposition (IVD) are common types of surface treatment for Nd-Fe-B magnets.

The entire magnetic circuit should be carefully considered when designing with Nd-Fe-B to make sure the working point is well above the knee point on the demagnetization curve to avoid demagnetization.



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Because of their high maximum energy product and reasonable cost, Nd-Fe-B magnets have found many applications including spindle and stepper motors, servomotors, compressor motors, drive motors for hybrid and electric vehicles, electric generators for wind turbines, actuators, magnetic bearings, loudspeakers, computer hard disk drives, magnetic resonance imaging (MRI), sensors, flow meter and medical devices.