Types of Magnets

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Natural Magnets

Natural magnets are found in the earth and are rich in an iron mineral called magnetite. Natural magnets date back to ancient times when they were used as compasses to navigate the world.

Lodestone is magnetite that is naturally magnetized and attracts metals like iron. It is one of the only minerals that is naturally magnetized.

Man-Made Magnets

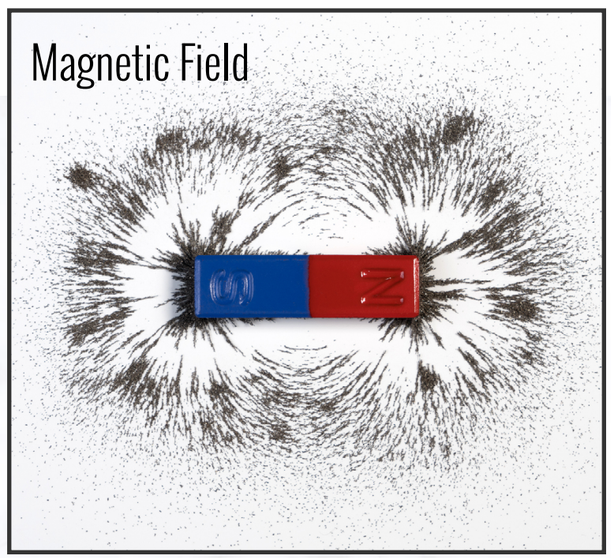
Man-made magnets are developed in a lab by taking metallic alloys and processing them to align the charge. These magnets are made up of different atoms and molecules that are ferromagnetic material. Ferromagnetic material, is what the other materials magnets are made of are attracted to.

These atoms and molecules have a magnetic field that allows them to reinforce each other. They either attract or repel the material from their poles, the north or the south. Nickel, cobalt, steel, and iron are a few of the ferromagnetic materials that have strong magnetic properties.

Four Main Kinds Of Magnets

Within these four different kinds of magnets there are also different types of magnets.

- Permanent Magnets
- Temporary Magnets
- Electromagnets
- Superconductors



Permanent Magnets

Permanent magnets are used in everyday life. Once permanent magnets have been magnetized they retain their magnetism to a certain degree. Permanent magnets do vary in strength and power. Measuring the strength and power of a magnet requires different equations but uses gaussmeters, magnetometers, and pull-testers. Some are very hard to be demagnetized, however they can still be damaged.

Magnetic attraction of the atoms may become damaged if other magnets or magnetic materials are in close proximity. Extreme temperature conditions of highs and lows can also demagnetize the magnets. Although their appearance is solid, handling them with care is extremely important. Dropping, hammering, jarring and using force on the magnet can also demagnetize the material.

Permanent magnets come in many different shapes and sizes and depending on the material can be molded into various shapes. They can also be flexible with different degrees of thickness and lengths.

To learn more information on magnets check out our **guide section**.

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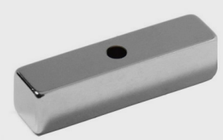
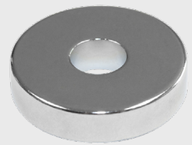
Flexible magnetic strips or sheets are made of a ferromagnetic powder mixed with a polymer bonding. These high energy strips resist demagnetization, and will not chip, crack, or shatter.

Flexible magnetic material can be magnetized with two or more poles along the length of the face, creating concentrated strength on the face of the magnet.

4 main types of permanent magnets.

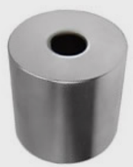


Neodymium Iron Boron



Samarium Cobalt

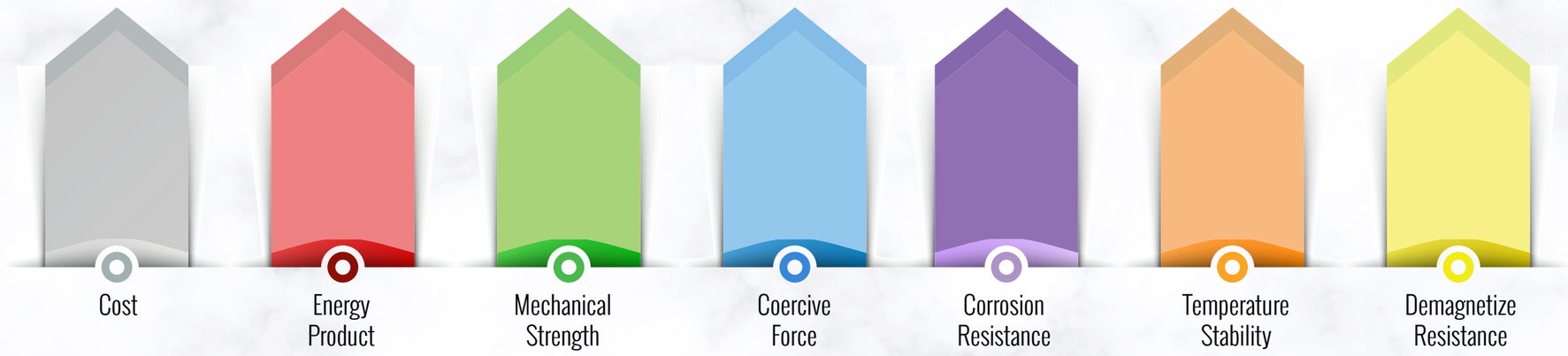
Ceramic or Ferrite



Alnico

Pros and Cons

The four different types of permanent magnets all have different pros and cons. For each one you will find a graph showing some of the important characteristics help determine which magnet might fit your need for your application.



Cost - This shows if they are a high or low cost. Higher cost magnets are more powerful and may be more durable then the lower priced magnets.

Energy Product Value - This shows the strength of the magnet. The magnet will generate a stronger magnetic field if the energy product value is high. Mega Gauss Oersted (MGOe) is how the energy product value is measured. A magnets strength is the product of two measurements. The magnetic field intensity (H) is measured in Oersteds and the magnetic flux (B) is measured in Gauss.

Mechanical Strength - This shows the strength of the magnet material. Magnets often must be handled with care because they can be brittle, which makes them crack and chip easily. Many magnets are also coated to help improve its mechanical strength.

Coercive Force - This shows the opposing magnetic field intensity that is needed in order to make a fully magnetized object magnetic flux density to zero. The energy that is required to lower the magnetization shows how resistant the material is to demagnetization.

Corrosion Resistance - This shows how resistant the magnet is to corrosion. It is also important to note that some magnets can be coated and this can increase their resistance.

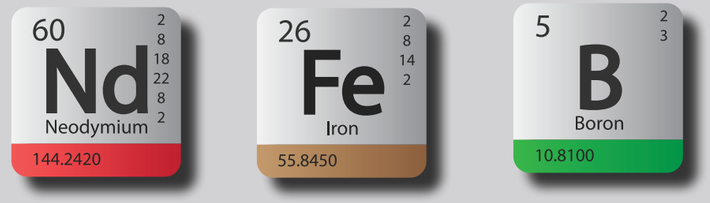
Temperature Stability - This shows if the magnet is stable in high and low temperatures. Low stability means it can't withstand drastic changes in temperature. Whereas high stability is when the magnet functions well across a range of temperatures.

Demagnetize Resistance - This shows if the magnet is easily demagnetized. A high level means the magnet is resistant to being demagnetized. A low level means it can easily be demagnetized.

Neodymium Iron Boron (NdFeB- NIB - Neo)

Neodymium Iron Boron magnets are a type of rare earth magnetic material. These magnets are known by a few different names. It can be seen as NdFeB because it is made from an alloy of these three different materials.

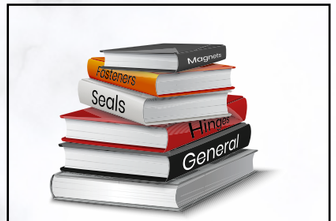
The Nd is the symbol for the chemical element Neodymium, Fe is the symbol for the chemical element Iron and B is the symbol for the chemical element Boron. NIB and Neo are just abbreviations, NIB standing for Neodymium Iron Boron and Neo is just short for Neodymium.



Applications

Neodymium magnets are used in a wide variety of applications.

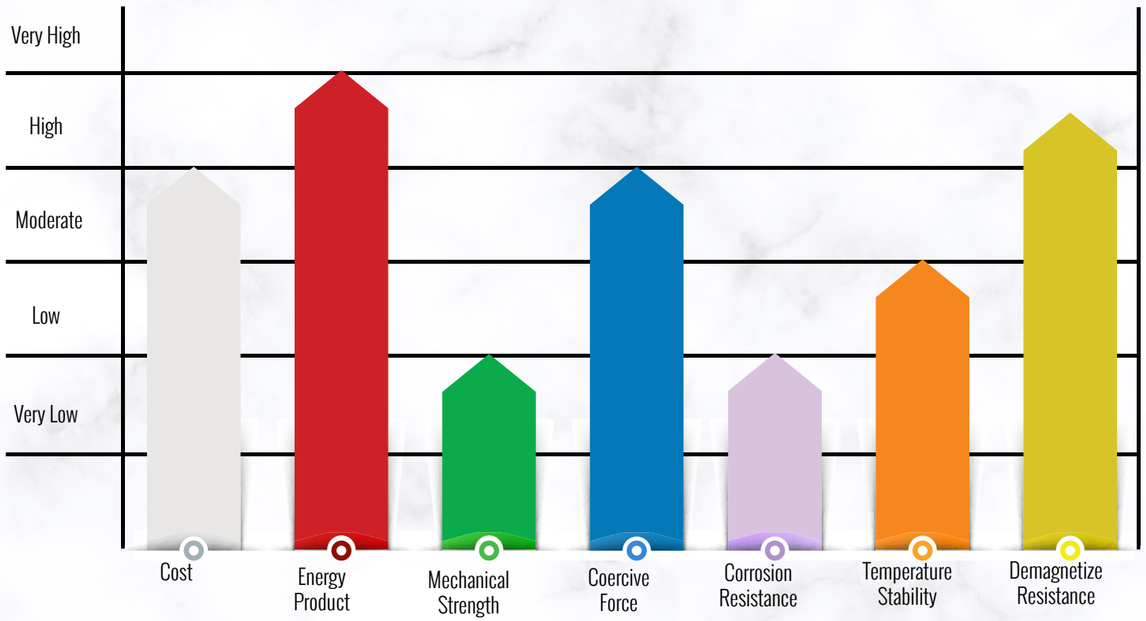
- Computers
- Hard disks
- Headphones
- Generators
- Motors
- Wind turbines



Find out more!
NEO MAGNETS GUIDES!

These magnets are high energy products and very magnetically strong that are hard to demagnetize. They can be made in very compact and small sizes because they have a high energy level. Neo magnets are brittle and corrosive because Neodymium reacts to oxygen and oxidizes if untreated.

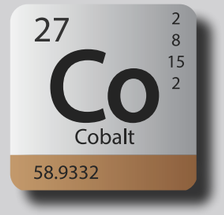
That's why a protective coating is needed. The coating is so thin that it doesn't significantly impact the force of the magnet. Although they are very strong, light, and moderatly affordable they are neodymium based so when exposed to low temperatures they can lose their magnetism.



Samarium Cobalt (SmCo)

Samarium Cobalt or SmCo which stands for its chemical elements, are also in the family of rare earth magnets. They are very similar to the neo magnets as far as strength but the neo magnet is stronger.

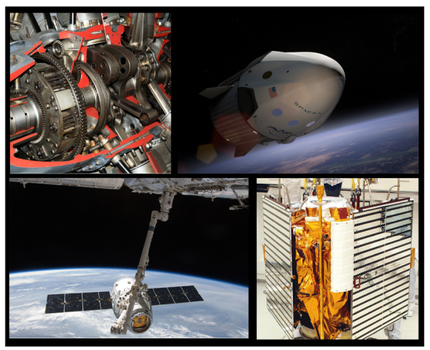
There are two different series of SmCo magnets that are based on their product energy range. The first being Sm1Co5 or Series 1:5 and the second Sm2Co17 or Series 2:17. Sm1Co5 has an energy product range of 15 to 22 MGOe and Sm2Co17 has an energy product range of 22 to 32 MGOe.

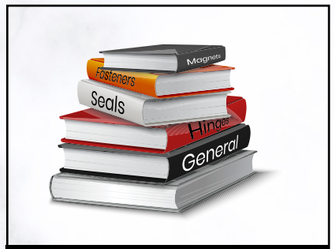


Applications

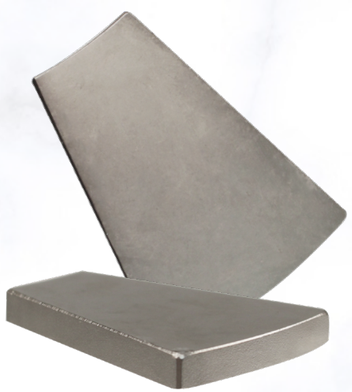
Samarium Cobalt magnets are used in a wide variety of applications.

- Sensors
- Traveling-wave tubes
- Space Probes
- Satelites
- High temperature applications



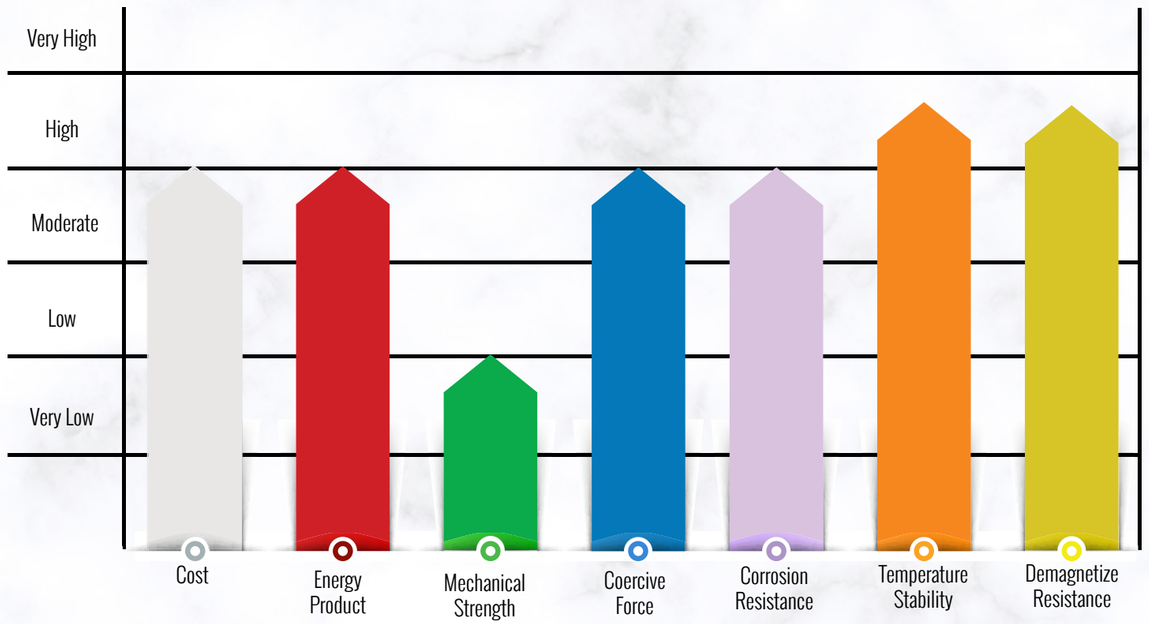


Find out more!
MAGNETS GUIDES!



The big difference, and depending on the grade, is they have little or no iron which means they are very resistant to corrosion unlike the neo magnets that are usually coated.

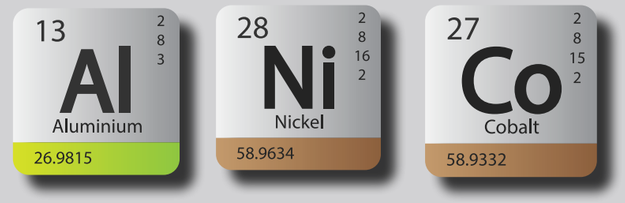
The other big difference is they can hold their magnetic properties across a much larger range of temperature. Which means that in high and low temperatures they are very resistant to demagnetization. Although they do stand up against corrosion they are brittle and can chip easily.



Alnico

Alnico is made from alloys of Aluminum, Nickel, and Cobalt. In fact it gets its name from the first 2 letters of each of the alloys. There are two different ways the Alnico magnets are manufactured.

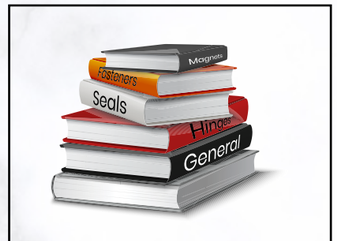
One is cast Alnico, and this allows the magnet material to be formed into many different shapes. Casting also gives a higher energy product that is often used in sensing devices, meters, and many other instruments. Sintering Alnicos makes the magnets have a stronger mechanical traits but the negative it lowers its magnetism.



Alnico magnets are used in a wide variety of applications.

- Meters
- Sensing devices
- Loud speaker
- Microphone
- MRI

Applications



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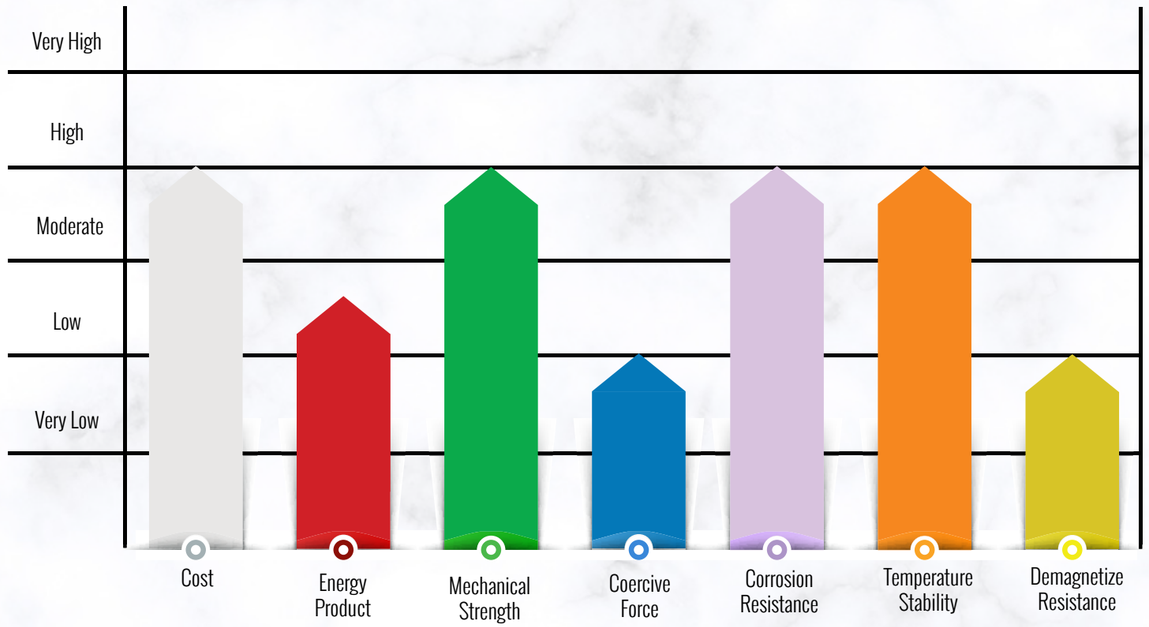
ALNICO MAGNETS GUIDES!

Unlike the other two rare earth magnets, Alnico can be demagnetized easily when they are not handled correctly. Although they have a good range of temperature stability and high energy often times they are replaced in many applications with rare earth magnets or ceramic.



Ceramic or Ferrite

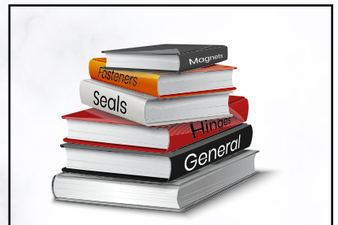
Ceramic magnets are also referred to as Ferrite magnets. The ceramic magnet is a nonmetallic compound of pure grades of iron oxide and strontium carbonate, and small quantities of other metal oxides. There are two different ways to make these magnets by pressing or sintering.

The compound is calcined, wet ball milled to a fine particle size powder, binders are added, then the mix is compacted in a press. The compacted shapes are fired at high temperatures in kilns to a closely controlled temperature cycle. Upon cooling, the parts are diamond sawed and diamond wheel ground to specifications.

Applications

Ceramic or Ferrite magnets are used in a wide variety of applications.

- ABS system
- Alternators
- Security systems
- Sound boards
- Crafts
- Meters
- MRI's

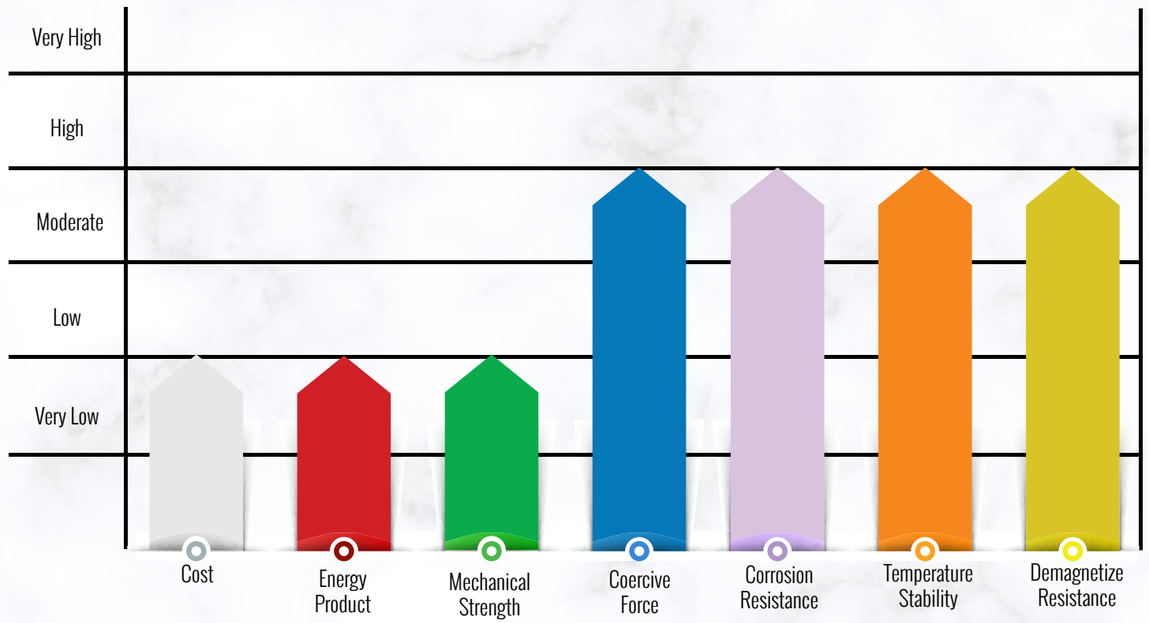


Find out more!

CERAMIC MAGNETS GUIDES!

These magnets are very brittle and chip and crack very easily. Corrosion resistance in Ferrite magnets is considered excellent, and no surface treatments are required.

Although, they are lower in energy level they have a pretty good balance of magnetic force and resistance to demagnetization. They can be magnetized with multiple poles on one or both pole surfaces. They are one of the most used magnets today.



Temporary Magnets

Temporary magnets are exactly what their name implies, temporary. The material, mostly soft iron or iron alloys, only works as a magnet when they are in the presence of a strong magnetic field or if there is a electrical current running through it. As soon as they are no longer in a magnetic field they lose their magnetic force.

The reason they are only temporary is unlike permanent magnets their atoms are not aligned all the time. The atoms of temporary magnets only become aligned when they contact a strong external magnetic field They can however be altered to be stronger by introducing steel through the coil.

An example of a temporary magnet would be nails when they come into contact with a magnet nail sweeper. Their magnetic force engages and they cling to the nail sweeper. Once they are taken off the nail sweeper they lose their magnetic force.

Electromagnets

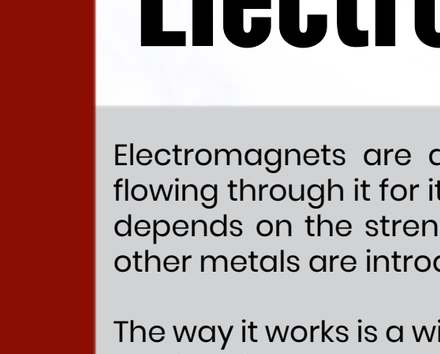
Electromagnets are a temporary magnet that needs to have electricity flowing through it for it to become magnetic. The strength of these magnets depends on the strength of the electric current that runs through it and if other metals are introduced.

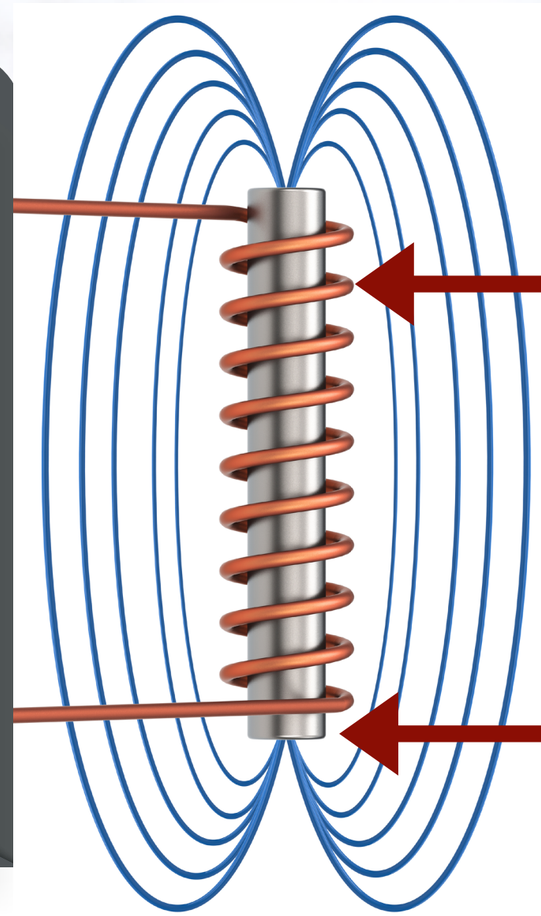
The way it works is a wire is tightly wound in a coil, often with a iron core. Once an electric current runs through the coil the atoms align and it magnetizes and acts as a permanent magnet. Once the current is gone the atoms rearrange and it loses its magnetism.

Applications

Electromagnets are used in a wide variety of applications.

- Lift Magnets
- Magnetic sweepers
- Speakers
- Computer
- Radios
- Televisions





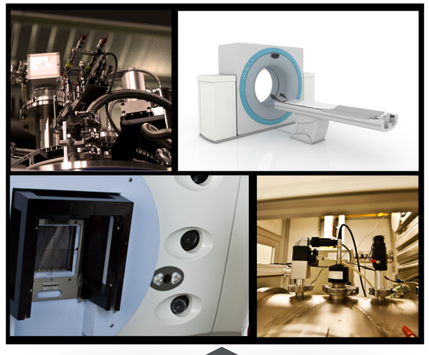
Superconductors

Superconductors are technically electromagnets because they are also made from a coil of wire like electromagnets. Unlike the electromagnets the special metal alloys the coils are made of don't have a metal core. They produce a extremely intense magnetic field and are the strongest magnets f them all.

The way it works is the wire must be cooled to a certain temperature in order for the special metal alloys to become superconductors. The materials change from one crystal state to another. When this occurs it has zero electrical resistance making the wire superconductors.

These magnets use hardly any power but there is often a high cost. The high cost is due to the refrigeration needed for the wires so they can cool to the temperatures needed in order to keep the superconductivity.

These are used in MRI machines, particle accelerators, and mass spectrometers.



Monroe Magnets

Monroe has a wide variety of magnets that can be used for various functions and applications. We have a number of materials, sizes and styles that are sure to be the right fit for you.

Along with the magnets listed in this guide we also offer the following:

- Cup Magnets
- Magnetic Catches
- Lift Magnets
- Material Handling Magnets
- Electro-Magnets Power Supplies
- Demagnetizers
- Flexible Magnets
- Custom

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