Neodymium Magnets (NdFeb)

Neodymium rare earth magnets are created from an alloy, which primarily consists of neodymium (Nd), iron (Fe) and boron (B). Additional elements are added depending upon the grade of magnet being produced and also the temperature it will be required to operate at, these typically include aluminium (Al), niobium (Nb) and dysprosium (Dy).

Once mixed the elements are placed within a vacuum furnace, heated and formed into an alloy via the process of vacuum induction melting which utilises electric currents to melt the elements whilst keeping them free of contaminants.

The resulting alloy is cooled into blocks or strips before being ground within a jet mill, which allows for specific sizes of particles to be produced. For the production of neodymium magnets the ground particles will usually be around 3 microns in size.

Following the milling process the particles are pressed together, the method used will vary upon the grade of magnet being produced and the manufacturer, the three primary methods of pressing are known as axial, transverse and isostatic. During the pressing process an external magnetic field is applied to align and set the magnetic domains of the particles in a single direction, known as the direction of magnetisation.

After the pressing process is complete the material is demagnetised before being sintered, this involves heating the material to extremely high temperatures but below the material's melting point in an oxygen free environment. Sintering fuses the already pressed particles together to form a solid mass, one complete the magnet is quickly cooled by a process known as quenching. This maximises magnetic performance and minimises any variants of the alloy that exhibit poorer magnetic properties, which can develop at temperatures below sintering.

When cooled the magnet is machined to the required shape using wire cutting electric discharge or diamond cutting tools, cleaned and dried before being plated to prevent corrosion. Most neodymium magnets are then triple coated with a base layer of nickel, followed by copper and finished with another layer of nickel, other specialist coatings may be applied for specific requirements.
The magnet is then placed within a solenoid coil and exposed to a magnetic field at least 3 times stronger than the magnets required strength, and magnetised to saturation to achieve the maximum magnetic output, this is achieved by aligning the magnet and it's direction of magnetisation with the magnetising field.

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