Alnico Magnets

Alnico is an acronym for a family of iron-based magnet alloys which also contain aluminum (Al), nickel (Ni), cobalt (Co), hence, *al-ni-co*. The magnets also contain copper (Cu) and, sometimes, titanium (Ti). A typical Alnico magnet contains 7–12% Al, 14–25% Ni, 5–38% Co, 3-4% Cu, with the balance being Fe.

Alnico magnets have very high Curie temperature (about 800 °C). They offer very good thermal stability and can be used at temperatures as high as 540 °C. Alnico is brittle and electrically conductive. Its residual induction (B_r) is very high (up to 13.5 kG), but the intrinsic coercivity (H_{ci}) is very low (typically from 550 to 2000 Oersteds), therefore Alnico magnets can be easily demagnetized by external demagnetizing fields.

Self-demagnetization should be taken into consideration when designing magnetic systems with Alnico magnets. The working point of Alnico magnets must be sufficiently high in order to avoid self-demagnetization. For an Alnico magnet assembly, removing the magnets from other magnetic components could lead to the change of magnetic flux because the stand-alone Alnico magnet could be working below the knee on the demagnetization curve.

Of course the low intrinsic coercivity of Alnico magnets can also be used as an advantage because they can be easily magnetized as part of a magnet assembly. The magnetic properties of Alnico magnets can also be easily tuned or adjusted in an assembly.

The resistance to demagnetization of Alnico magnets can be improved by an increase in the dimension along the easy axis (magnetization direction). A larger effective L/D ratio helps move the working point higher. For most applications, Alnico magnets are normally fairly long with bar, rod or horseshoe shapes most common. The working point or the permeance coefficient (P_c) must be carefully considered in the design process in order to get the most out of Alnico magnets.

With the right design, Alnico can be a very powerful magnet with superior thermal stability and corrosion resistance. Applications of Alnico magnets include microphones, sensors, loudspeakers, traveling-wave tubes and cow magnets. Although rare earth magnets have become more popular due to their high magnetic flux density and high intrinsic coercivity, Alnico magnets continue to be selected for some magnetic systems, especially if they would operate at extremely high temperatures.