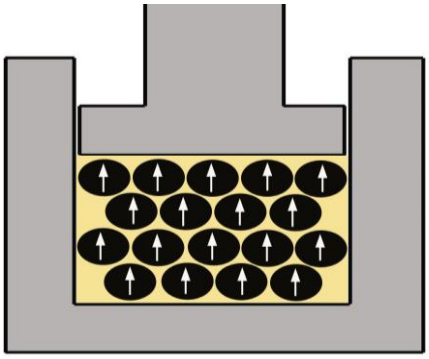
Dura Magnetics, Inc.

Magnetization Options for Neodymium Iron Boron, Samarium Cobalt, Ceramic Magnets:

Most useful commercial magnets are anisotropic which means that they have an "Easy" or preferred direction of magnetization and that an orientation field was applied during the compaction stage of the manufacturing process.

It is essentially impossible to magnetize the resulting anisotropic magnet alloy other than in the Direction of Orientation; however, various pole configurations can be achieved without conflicting with the magnet material's orientation.

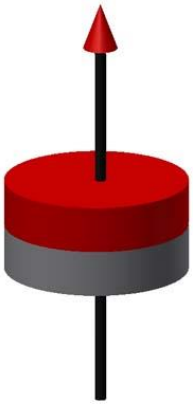


Alignment of particles during the powder pressing phase with an external field to create an anisotropic magnet alloy

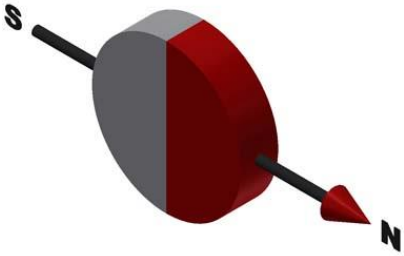
Below are conventional and standard industry options for the MAGNETIZATION directions of Rare Earth Neodymium Iron Boron, Samarium Cobalt, and Ceramic magnets.

Disc Geometry

Axially Magnetized Disc



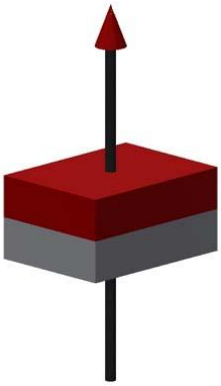
Diametrically Magnetized Disc



Polarity Nomenclature:
Typically the arrowhead indicates the North pole of the magnet. For symmetric geometries indicating the location of a particular pole is unnecessary, but for non-symmetric geometries identifying a particular pole location is very important.

Example: An axially Magnetized disc magnet does not require communication as to the NORTH pole's position, but a radial arc does. One must indicate if the NORTH pole is to reside on the Inner radius or Outer Radius.

Block Magnet

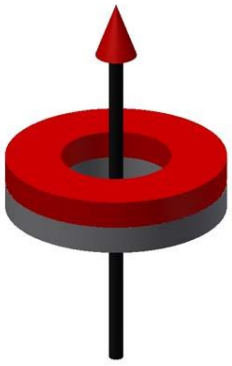


"Block Magnets" or Rectangular / Square magnets have three potential orientation directions.

The block magnet can be polarized in any direction.

Ring Geometry

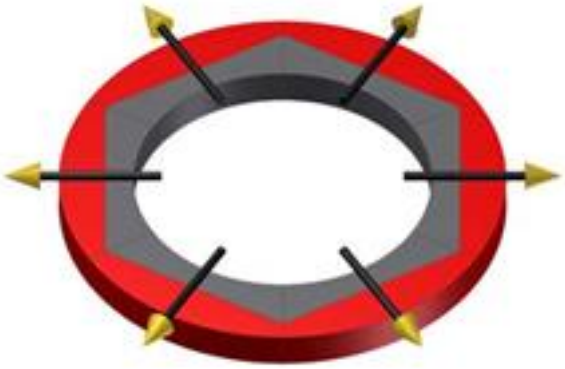
Axially Magnetized Ring



Diametrically Magnetized Ring

Radial Magnetization:
Radially oriented and magnetized rings are available in Neodymium Iron Boron, but there are many limitations in alloy grade, Outside Diameter/Inside Diameter ratio, axial, length, etc. Specialized tooling must be created and there is an upfront capital investment which acts as a cost inhibitor for most applications. (Radially oriented and magnetized Samarium Cobalt is not offered.)

True Radially Magnetized Ring

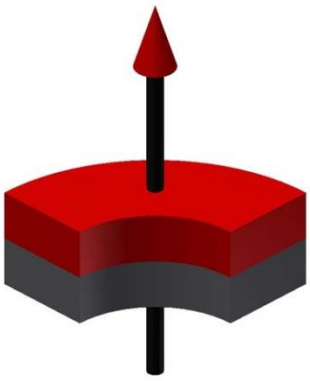


Radially Approximated Ring Comprised of Approximated Radial Arc Segments

Radial Ring Magnetization Approximation:
Neodymium Iron Boron, Samarium Cobalt, and Ceramic magnets can be approximated by arcs segments; however, in most cases the magnets must be assembled magnetized and there must be a large performance benefit to the application to absorb this cost.

As with “True” radial rings, true radial Arc Segments are difficult to manufacture, but can be approximated themselves. See Below.

Arc Segment Geometry

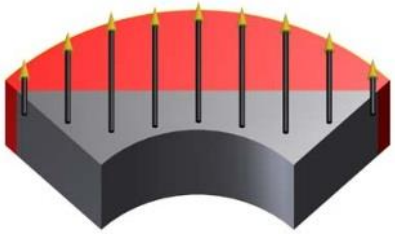


Axially Magnetized Arc Segment

True Radial Arc Segment

Radially IN / Radially Out:
An arc segment can be polarized NORTH or SOUTH on the Outside Radius. (The resulting opposite pole will reside on the Inside Radius.)

It is very difficult to achieve a true "radial" orientation during the pressing/alignment stage of manufacturing and therefore, truly radial Neodymium Iron Boron, Samarium Cobalt, and Ceramic magnet arcs are rare and specialized. (An approximation of a true radial Orientated Radial Arc is widely utilized in industry.)



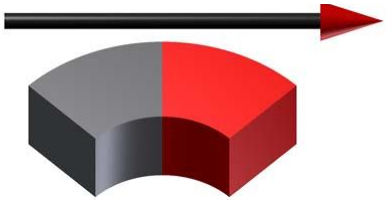
Approximated Radial Arc

The approximated radial arc utilizes linear orientation/magnetization along a straight axis. The radial component diminishes on the leading and trailing edges of the approximated radial arc.

Circumferential:
Circumferential Orientation and Magnetization is not available for Arc magnets comprised of Neodymium Iron Boron and Samarium Cobalt; however, this magnetization geometry can be approximated.

True Circumferential Arc

Approximated Circumferential Arc



The approximated radial arc utilizes linear orientation/magnetization along a straight axis. The radial component diminishes on the leading and trailing edges of the approximated radial arc.