

Retaining magnets / Raw magnets - Materials of the magnet

6

Retaining magnets

Hard ferrite (HF)

SrFe (Strontium ferrite)

Magnets made of hard ferrite (80% iron oxide) are made by sintering process.

Like all ceramic materials, these magnets are very hard and brittle and virtually non-machinable.

The magnetic adhesive force drops when the magnet is heated.

AlNiCo (AN)

Aluminium nickel cobalt

Magnets made of AlNiCo (main constituents include aluminium, nickel, cobalt and iron) are made by sintering or casting process.

The material is very hard and tough, but can be redressed.

These magnets are used in applications in which the magnetic field is to remain as static and stable as possible, also under higher temperature fluctuations.

SmCo (SC)

Samarium cobalt

Magnets made of SmCo (main constituents include samarium and cobalt) are made by sintering process.

The material is very hard and brittle and is virtually non-machinable.

The magnetic adhesive force drops when the magnet is heated.

NdFeB (ND)

Neodymium iron boron

Magnets made of NdFeB (main constituents include neodymium, iron and boron) are made by sintering process.

The material is very hard and brittle and is virtually non-machinable.

This material delivers ultimate magnetic holding power.

The magnetic adhesive force drops when the magnet is heated.

Materials of the magnet in comparison				
Description	Hard ferrite (HF)	AlNiCo (AN)	SmCo (SC)	NdFeB (ND)
Adhesive force	good	medium	strong	very strong
Max. working temperature *)	≈ 200 °C	≈ 450 °C	≈ 200 °C	≈ 80 °C
Corrosion resistance	very good	very good	good	less good
Machineability	not possible	diamond cutting, grinding	not possible	not possible
Demagnetisation capability	moderate	easy	very difficult	difficult
	by demagnetising fields	by demagnetising fields	only by large demagnetising fields	only by large demagnetising fields
Price	very reasonable	high	very high	reasonable

*) The max. temperature used is only a guide value because it also depends on the dimensions of the magnet.

Retaining magnets / Raw magnets - Adhesive forces

Other factors apart from the magnet material and the size of the magnet affecting the magnetic adhesive force are:

- an air gap (magnetically non-conductive materials act like an air gap)
- the quality of the surface (roughness and shape)
- the temperature
- the content of ferro-magnetic material in the steel or its volume to absorb the entire magnetic flux.

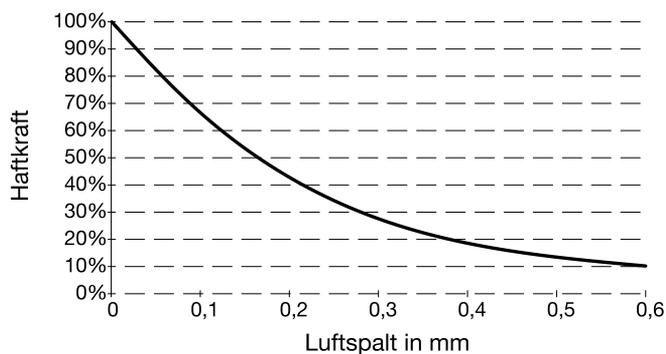
The magnetic adhesive force can also be impaired by alternating thermal stress and by chemical factors (aggressive baths, gases, etc.).

The diagrams and graphs below show guide values relating to the impact on the magnetic adhesive force caused by different mechanical specifications.

The nominal magnetic adhesive forces shown in the tables of the standard pages are minimum values which are achieved at:

- room temperature
- perpendicular „tear-off“ under full surface contact of the magnet
- workpieces made of low-carbon steel with a minimum thickness of 10 mm

Influence of the air gap

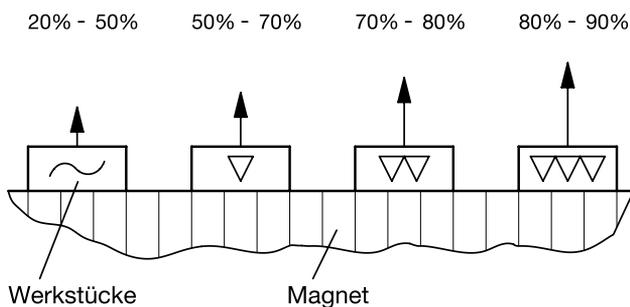


Influence of the material (Steel grade)

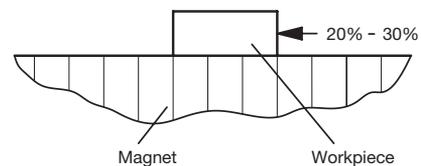
100%	technically pure iron	86%	C60, X6Cr17
95%	St37, C15	84%	42CrMo4
94%	St44-2, 34CrNiMo6	75%	St50
93%	St52-3	72%	X155CrMo12
92%	90MnV8	65%	X210CrW12
90%	C45	50%	20MnCr5
87%	Ck45	30%	GG

Hardened workpieces are bad conductors of the magnetic flux. The magnetic adhesive force is therefore lower.

Influence of the workpiece surface on the magnetic adhesive force



Displacement force = 20 % to 30 % of the magnetic adhesive force



The displacement force is also influenced by the surface roughness and the adhesion.