Glossary

【Magnetism and magnetic force】

Action of force exerted by a magnet is called “a magnetic force” and its source is called “magnetism.” When a substance comes to have magnetism, it is called “magnetized.” Expressions to indicate the magnetic force include two ways; physical “attraction” (holding power) and “strength of a magnetic field” (magnetic flux density) indicating a magnetized state.

【Magnetic substance and nonmagnetic substance】

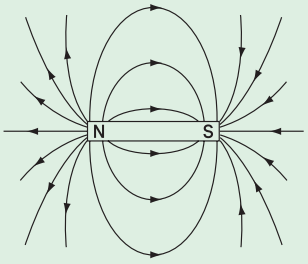
A substance that is magnetized strongly in the direction of the magnetic field in the magnetic field is called a magnetic substance (ferromagnetic substance). On the contrary, a substance that is hardly magnetized is called a nonmagnetic substance (paramagnetic substance or diamagnetic substance).
Examples:Magnetic substances: Iron, nickel, cobalt
Nonmagnetic substances: Aluminum, brass, oxygen, water

【Holding power and maximum holding power】

Normally the force of a magnet is called “attraction,” but this is a physical phenomenon seen from the magnet side. We at KANETEC express this force as a holding power by which a workpiece (to be attracted or machined) is held by a magnet.
The holding power indicates a force when a workpiece is pulled perpendicular to the attractive face. This power, however, varies largely depending on such factors as workpiece shape, material, thickness, surface roughness, flatness, clearance, use or nonuse of heat treatment and specifications of products to hold. The holding power that can be obtained under the most favorable conditions is called the “maximum holding power.”
The holding power used to be expressed by a unit “kgf” (kilogram-force). In the SI Unit (International System of Units), it is expressed by an “N” (Newton).
[1N ≒ 0.102 kgf, 1 kgf ≒ 9.81 N (indicated as 10 N)]

【Magnetic flux density】

The magnetic flux density refers to an amount of magnetic flux per unit area. The magnetic flux is invisible, but when iron powder is scattered on a white sheet of paper placed on a magnet, its distribution can be seen. The unit of the magnetic flux is “Wb” (Weber). The amount of magnetic flux per cross sectional area 1 m^2 is expressed by the magnetic flux density. The magnetic flux density 1 W/m^2 is 1 T (Tesla). (The conventional unit is G (Gauss), but in the SI Unit, it is T (Tesla) 1 T = 10,000 G, 1 mT = 10 G)



【Lifting capacity and safety factor】

The capacity of lifting magnets and transfer magnets varies largely depending on such factors as material, thickness, shape, surface roughness of workpieces and lifting speed.
The lifting capacity is indicated by 1/2, 1/3, 1/4, etc. of the max. holding power for each product in consideration of negative elements encountered during actual use of products. “Max. holding power” / “lifting capacity” is called a “safety factor.” If the plate thickness is thin or a clearance is large, the holding power drops considerably. Therefore, there are cases that it is difficult to lift a weight indicated by the lifting capacity. When judging a required lifting capacity, caution must be taken.

【Residual magnetism (residual magnetic flux density) and residual holding power】

This is a magnetic force that remains in the substance from which the external magnetic flied has been removed. A holding power that is generated by the residual magnetism is called the residual holding power.

【Excitation (forward excitation) and reverse excitation】

Applying electric power to the coil to produce a magnetic field is called excitation (forward excitation). Applying electric power in the reverse direction to produce a magnetic field is called reverse excitation.

【Reduction of magnetization】

This term is often used when electromagnetic chucks are used. This is an electric treatment to reduce the remaining magnetic flux density (residual magnetism), which is a cause of some residual holding power that remains between the workpiece and the electromagnetic chuck after it has been powered off.

【Demagnetization】

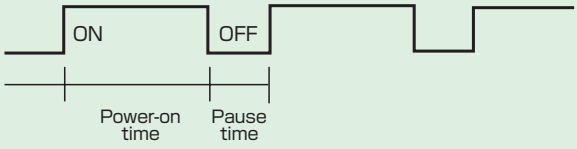
This is a treatment to force the residual magnetism in magnetic devices and magnetized workpieces to be reduced by an electric action without depending on natural decay.

【Rectifier】

An electric device to convert an input from an ordinary alternating current (AC) power source to a direct current (DC) and output it in order to obtain efficient excitation current for electromagnetic chucks, lifting magnets, demagnetizers, etc.

【Working rate (Power-on rate)】

When operating (applying electricity to) a demagnetizer or electromagnetic Lifma frequently, it is necessary to set forth a rule of continuous power-on time (upper limit) and pause time in order to avoid saturation due to overheat. A series of power-on to pause is called one cycle and a ratio of the power-on time is called the “working rate.”



$$\text{Working rate} = \frac{\text{Power-on time}}{(\text{Power-on time} + \text{pause time})} \times 100(\%)$$

【Magnetic materials】

	Ferrite	Alnico	Rare Earth	
			SmCo family	NdFe family
Magnetic force	△	○	◎	◎
Stability	○	△	◎	◎
Heat resistance	△	◎	○	△
Mechanical strength	△	◎	△	○
Cost	◎ (Low)	○ (Normal)	△ (High)	△ (High)

◎ Superior ○ Normal △ Inferior

●Ferrite magnet
When the holding power at 20℃ is 100%, it drops to about 85% at 50℃, about 70% at 100℃ and below 40% at 200℃.
When the magnet returns to normal temperature, the original magnetic force cannot be recovered.

●Alnico magnet
Of three magnet materials, this is superior in terms of temperature characteristic. When the holding power at 20℃ is 100%, it drops to about 96% at 100℃, about 93% at 200℃ and about 89% at 300℃.
When the heat resistance of other components constituting the magnet is disregarded, the alnico magnet can be used up to 450℃ to 500℃.

●Rare earth magnet
When the holding power at 20℃ is 100%, it drops to about 95% at 100℃ and about 85% at 200℃.
Some magnets of neodymium・ferrous (NdFe) family may not recover the original magnetic force when the temperature above 60℃ returns to normal temperature.
Magnets of samarium・cobalt (SmCo) family are superior to ferrite magnets in temperature characteristic, but their upper temperature limit for continuous use is 150℃ in consideration of deterioration. For intermittent use for a short period of time, they may be used up to 200℃.

【Isotropic/Anisotropic】

Magnet materials have isotropy and anisotropy with regard to magnetizing property and anisotropy generates a stronger magnetic force than isotropy. However, it is more expensive. When magnetizing magnet materials, magnets that can be magnetized uniformly in all directions are called isotropic magnets and those that are magnetized most strongly in a particular direction are called anisotropic magnets.