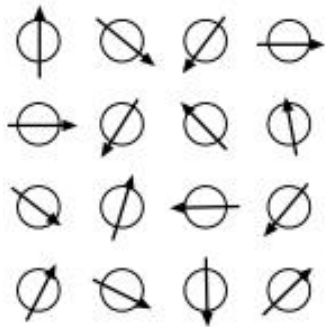


# *Magnetism on ferromagnetic workpieces*

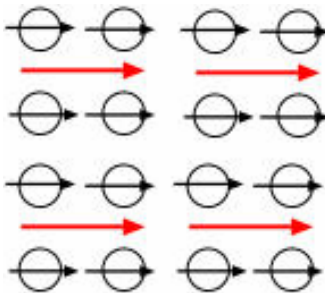
- Content
  - Basics of magnetism in ferromagnetic parts
  - Application of the hysteresis curve on ferromagnetic parts
  - Differences in magnetic properties of materials
  - Magnetically hard spots
  - Remagnetization of parts and it's causes
  - Causes for full north south magnetization
  - Causes for superficial magnetization

# Magnetism on ferromagnetic workpieces

- Basics of magnetism in ferromagnetic parts
  - Orientation of magnetic dipoles



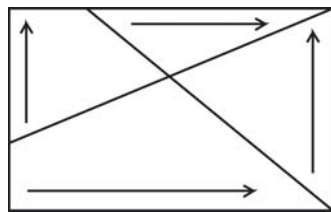
The magnetic dipoles have a random orientation  
-> The workpiece is not magnetic



The magnetic dipoles are directed in one direction  
-> The workpiece is magnetic

# Magnetism on ferromagnetic workpieces

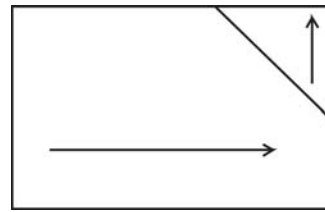
- Basics of magnetism in ferromagnetic parts
  - Magnetization due to shifting of Bloch walls



→ H [kA/m]

Small wall displacement by the action of a weak external field H. This situation is **reversible**, Bloch walls have not shifted.

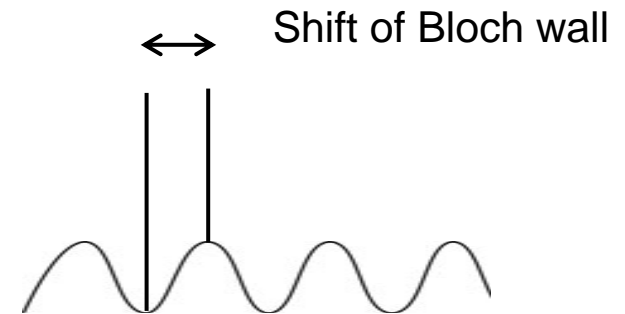
-> Part is not magnetized



→ H [kA/m]

Large wall displacement by the action of a strong external field H. This situation is **irreversible**, Bloch walls have shifted.

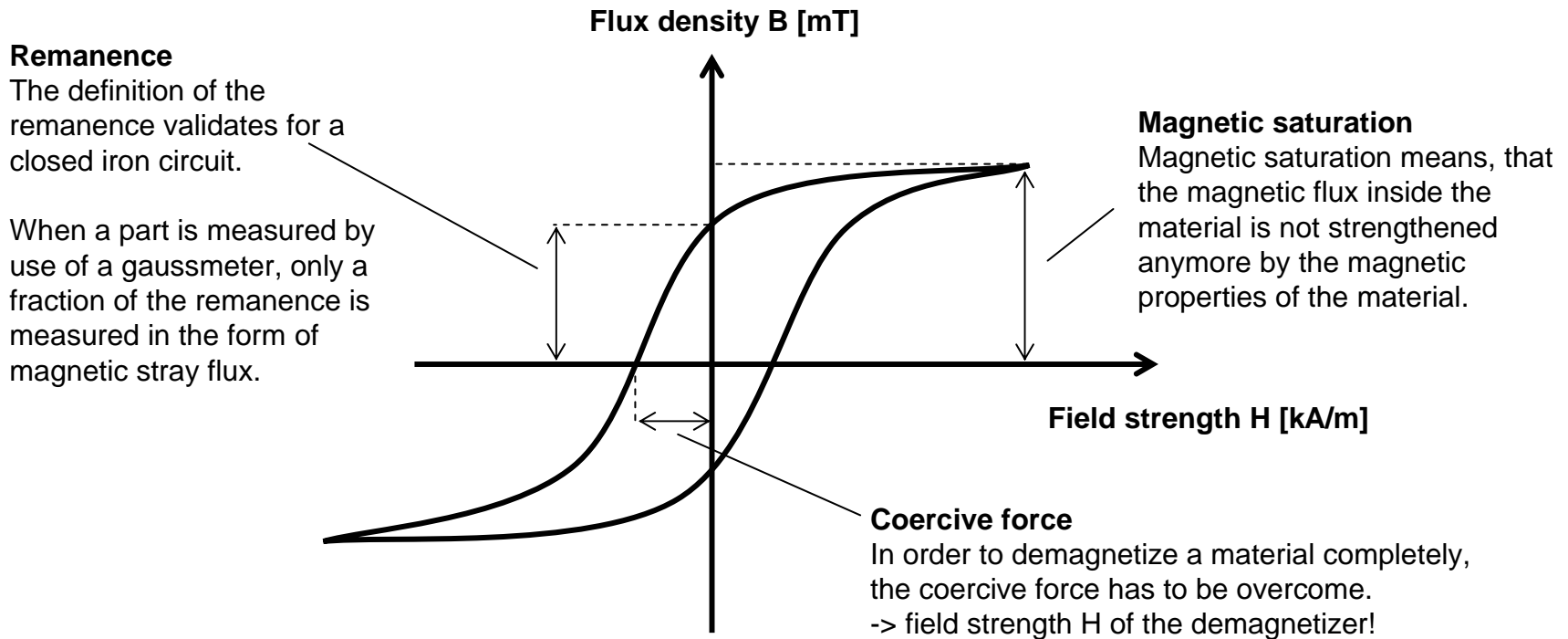
-> Part is magnetized



Bloch walls jump discontinuously. For this reason the magnetization of a material takes place in small, discontinuous jumps.

# Magnetism on ferromagnetic workpieces

- Hysteresis curve applied to ferromagnetic parts



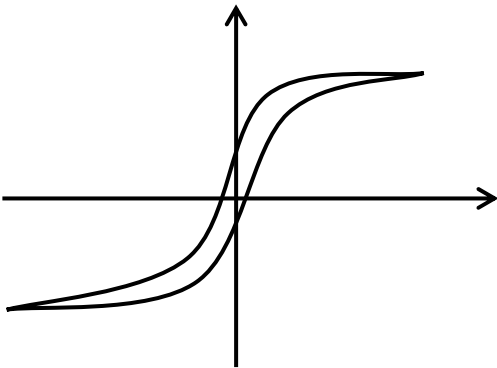
# Magnetism on ferromagnetic workpieces

- Differences in magnetic properties of materials

## Magnetically weak

e.g. CK15, CK45, machining steel, construction steel S235, S355 etc.

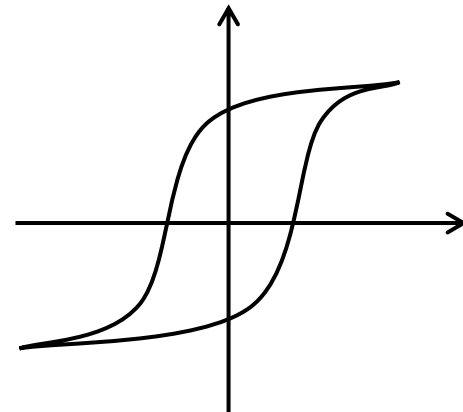
- small coercive force



## Magnetically hard

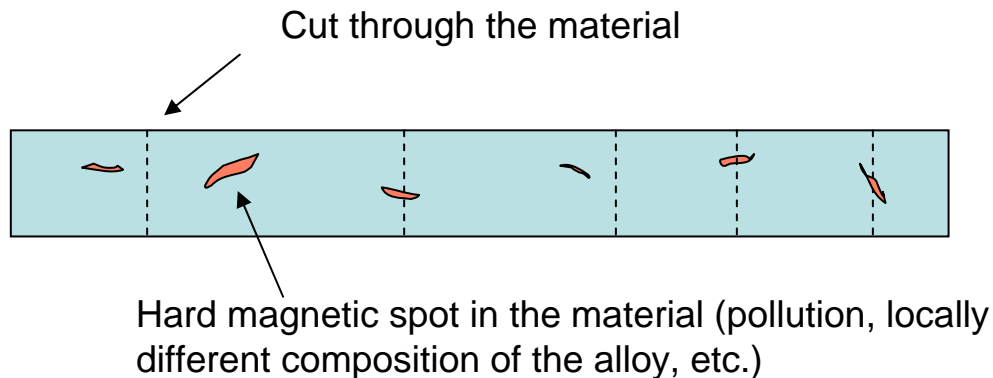
e.g. alloyed chromium nickel steel, ball bearing steel, alloyed sintered metal, carbides etc.

- big coercive force



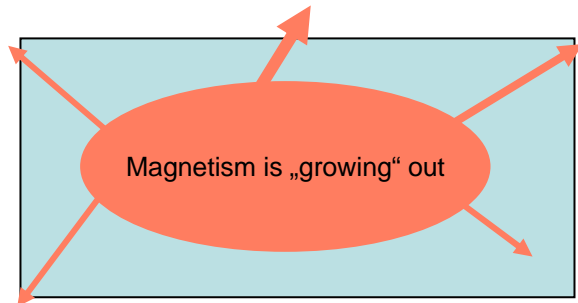
# Magnetism on ferromagnetic workpieces

- Magnetically hard spots in workpieces
  - Spots with high coercive forces
  - These spots can cause unwanted magnetization of the workpiece
  - Demagnetization needs high magnetic field strength



# Magnetism on ferromagnetic workpieces

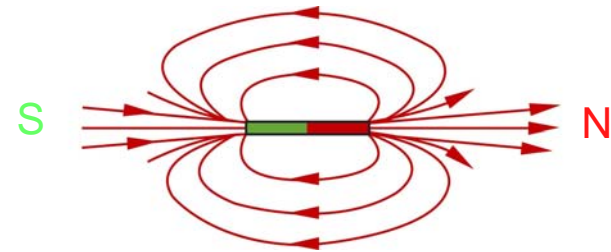
- Remagnetization of workpieces. This effect is favored by:
  - shocks, vibrations etc.
  - Easily magnetizable materials
  - Long geometries like rods, tubes etc.
- Magnetism reappears after a certain time
  - The same matters as above
- Causes
  - Adverse effects of static magnetic fields (magnetic field of earth, etc.)
  - Incomplete or no demagnetization at all
  - Demagnetization with low penetration effect



# Magnetism on ferromagnetic workpieces

- Full north south magnetization

- Trajectories of the field lines:



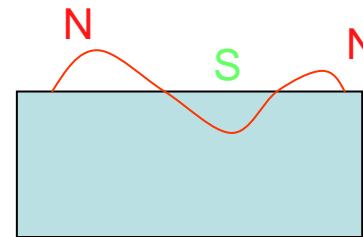
- Typical causes

- Crack detection with DC current (NDT)
  - Welding with DC current
  - Storage of long rods and tubes parallel to the magnetic field of earth
  - Demagnetization of long material without compensation field or shielding
  - "Freezing" of the earth's field in the cooling phase of long parts like rods, tubes etc. during manufacturing process
  - Forming

# Magnetism on ferromagnetic workpieces

- Superficial magnetization

- Trajectories of the field lines:



- Typical causes

- Use of lifting magnets
- Use of magnetic clamping plates or chucks
- Machining with magnetic or stump tools -> stump tools lead to a superficial forming due to high cutting forces
- Use of magnetic surface gauges etc.

# *Magnetism on ferromagnetic workpieces*

- Maurer Magnetic AG, your specialist for
  - Industrial demagnetizers
  - Instruments for measuring magnetic fields
  - Degaussing services
  - Troubleshooting in the field of magnetism
  - Magnets and magnetic systems