$\vec{B} = \mu_0\vec{H} + \vec{J} = \mu_0\mu_r\vec{H}$

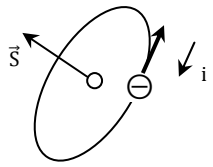
$\vec{J} = \mu_0\chi_m\vec{H}$

→ mag. susceptibilita [–]

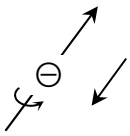
<0 **diamagnetika**

>0 **paramagnetika**

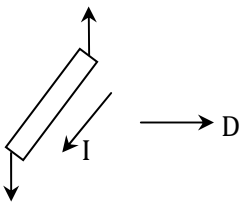
≫0 **feromagnetika**

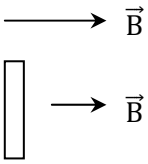


$\vec{m} = I.\vec{S}$ orbitální mag. moment

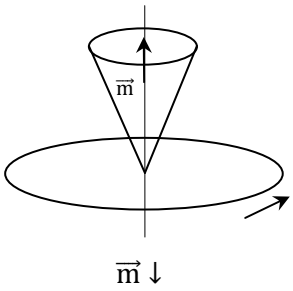


$\vec{m}_s$ spinový moment





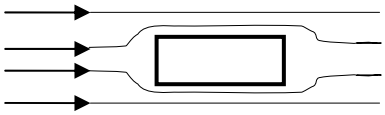
Diamagnetika



u materiálů, kde se vnitřní proudy ruší

$\vec{m}_1 + \vec{m}_2 + \cdots = 0$

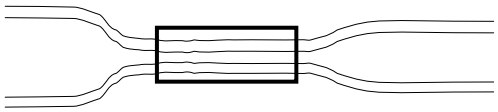
$\vec{B} - \vec{B}_i$



mag. pole odpuzují

Paramagnetika

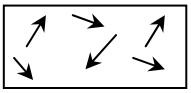
k vnějšímu poli se přičte vnitřní pole $\vec{B} + \vec{B}_i$



$\chi_m = f(t)$

$\vec{J} > 0$

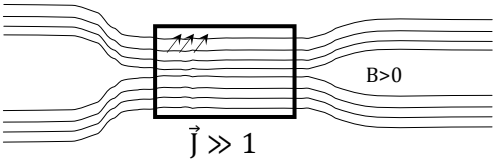
vnitřní momenty – čím větší teplota tím větší neuspořádání



bez pole

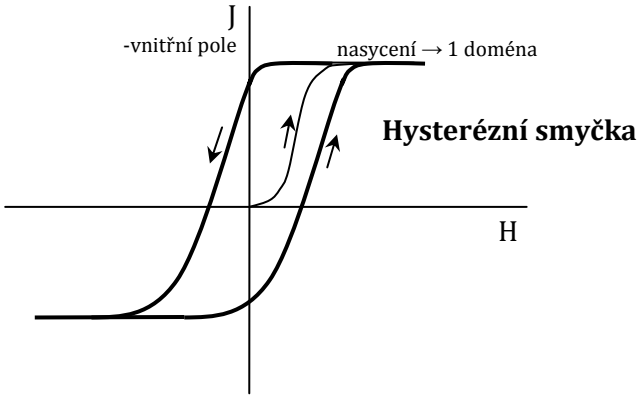
Feromagmetika

- nevykompenzovaný spinový moment
- pokud **NIKDY** nebylo v mag. poli, pak uspořádání jako u paramagnetik

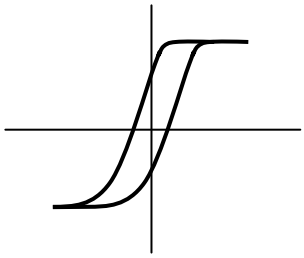


uspořádají se spin momenty až do jedné domény

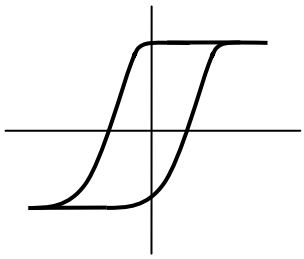
- po vyjmutí z mag. pole $\rightarrow \vec{J} \neq 0 \Rightarrow$ permanentní magnet



Měkké feromagnetika

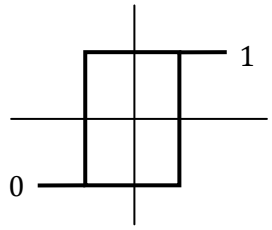


Tvrdé feromagnetika

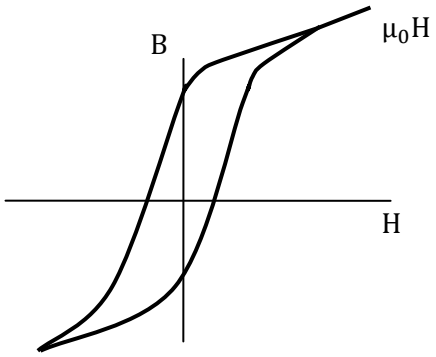


- např. analogový záznam

Speciální případy

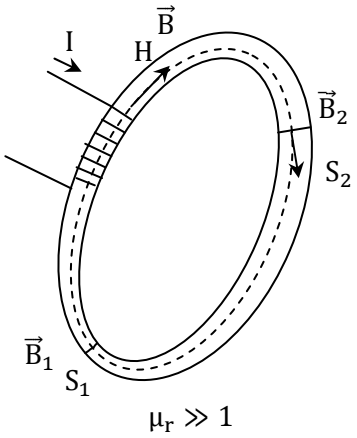


– digitální záznam



T_C – Kirriova teplota – nad touto teplotou se skokově stává z feromagnetika paramagnetikum

Magnetické obvody



$\mu_r \gg 1$

$$\Phi = \iint \vec{B}.\overrightarrow{dS}$$

$$\Phi = B.S$$

$$\Phi = \iint_{S_1} \vec{B}_1.\overrightarrow{dS} = \iint_{S_2} \vec{B}_2.\overrightarrow{dS} \doteq B.S \Rightarrow B = \frac{\Phi}{S}$$

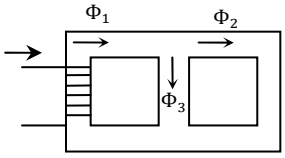
$$\oint_l \vec{H}.\overrightarrow{dl} = N.I$$

$$\vec{B} = \mu\vec{H}$$

$$\vec{H} = \frac{\vec{B}}{\mu}$$

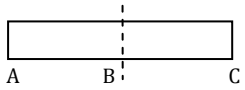
$$\oint_l \frac{\vec{B}}{\mu}.\vec{dl} = N.I$$

$$\oint_l \frac{\Phi}{\mu S}.dl = N.I \Rightarrow \Phi \underbrace{\oint_l \frac{dl}{\mu S}}_{R_m} = \underbrace{N.I}_{U_m} \qquad \boxed{\Phi R_m = U_m} \text{ Hopkinsonův zákon}$$



$$\Phi_1 = \Phi_2 + \Phi_3$$

$$\frac{U_m}{R_{m1}} = \frac{U_m}{R_{m2}} + \frac{U_m}{R_{m3}} \Rightarrow \frac{1}{R_m} = \frac{1}{R_{m1}} + \frac{1}{R_{m2}}$$



$$R_m = R_{m1} + R_{m2}$$

$$\int_A^B \frac{dl}{\mu S} + \int_B^C \frac{dl}{\mu S} = \int_A^C \frac{dl}{\mu S}$$

Př.

$\overline{d} = 150\text{mm}$

$S = 20 \times 20\text{mm}$

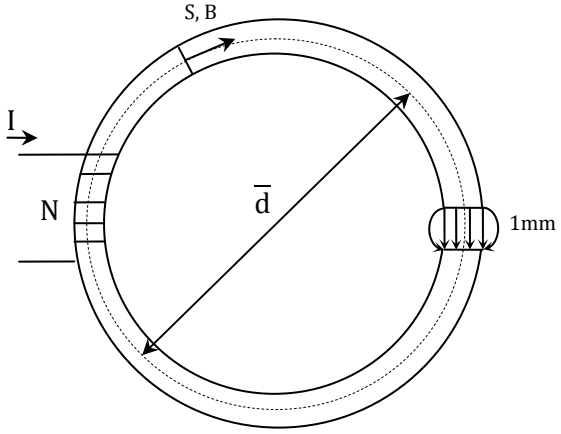
$m = 1\text{mm}$

$N = 1000$

$\Phi = 540\mu\text{Wb}$

$B^* = 1{,}35\text{T}$

$H^* = 1000\text{A.m}^{-1} \Rightarrow \mu = \frac{B^*}{H^*}$



$\Phi = \text{konst.}$

$B.S = B'.S$

$\mu_0\mu_r H = \mu_0 H'$

$\mu_r H = H'$

$\oint \vec{H}.\vec{dl} = N.I$

$$\int_{l-m} H.dl + \int_m H'.dl = N.I$$

$$H\int_{l-m} dl + H'\int_m dl = N.I$$

$H.l + H'.m = N.I$

$H.l + \mu_r.H.m = N.I$

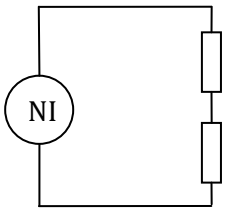
$\frac{B}{\mu}.l + \mu_r.\frac{B}{\mu}.m = N.I$

$\frac{\Phi}{\mu S}.l + \frac{\mu_r}{\mu_0\mu_r S}.m = N.I$

$\Phi\left(\frac{l}{\mu_0\mu_r S} + \frac{m}{\mu_0 S}\right) = N.I$

$\frac{\Phi}{N}.\left(\frac{l}{\mu_0\mu_r S} + \frac{m}{\mu_0 S}\right) = I$

po dosazení $I = 1{,}55\text{A}$



$N.I = \Phi(R_{mc} + R_{mm})$

$I = \frac{\Phi}{N}.(R_{mc} + R_{mm})$ $\quad R_m = \int \frac{dl}{\mu S}$

$I = \frac{\Phi}{N}.\left(\frac{l}{\mu_0\mu_r S} + \frac{m}{\mu_0 S}\right)$