Terms & Definitions / Begriffe und Definitionen

1. Initial permeability, μ_i / Anfangspermeabilität, μ_i

The initial permeability μ_i is the limit value at the initial magnetization curve´s origin point and is given by the following formula:

$$\mu_i = \frac{1}{\mu_0} \lim_{H \to 0} \frac{B}{H}$$

Where μ_0: Permeability of vacuum ($4\pi \times 10^{-7}$ H/m)
H: Magnetic field strength (A/m)
B: Magnetic flux density(T)

2. Effective permeability, μ_e / Effektive Permeabilität, μ_e

This is usually defined as the permeability of a core forming a closed circuit where leakage flux is negligiby small.

$$\mu_e = \frac{L}{\mu_0 N^2} \cdot \frac{L_e}{A_e}$$

Where L: self-inductance of core with coil(H)
N: number of turns
L_e: effective magnetic path length(m)
A_e: effective cross-sectional area(m^2)

3. Saturation magnetic flux density, Bs(T) / Sättigungsflussdichte, Bs(T)

The magnetic flux density at magnetic field where H is up to an approximate saturation magnetic field value. (Fig.1)

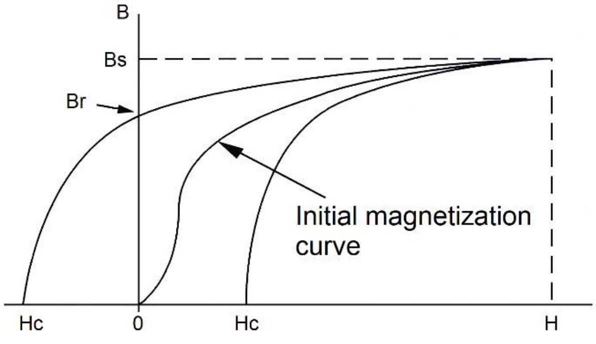

Fig.1

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**4. Residual magnetic flux density, (Br)
Magnetische Restflussdichte, (Br)**

The value of flux density retained by the core when the magnetic field is reduced from the sate of the effective saturation magnetic flux density to zero.(Fig.1)

5. Coercivity, Hc(A/m) / Koerzitivfeldstärke, Hc(A/m)

The value of magnetic field strength wherby the flux density becomes zero under the intensification, in the opposite direction, of the magnetic field. (Fig.1)

6. Loss factor, tan δ / Verlustfaktor, tan δ

This is the sum of the hysteresis loss factor, eddy current loss factor and residual loss factor.

Where $\tan\delta = \tan\delta h + \tan\delta e + \tan\delta r$
$\tan\delta h$ is the hysteresis loss factor
$\tan\delta e$ is the eddy current loss factor
$\tan\delta r$ is the residual loss factor

7. Relative loss factor, tan δ/µ / Bezogener Verlustfaktor, tan δ/µ

This is the ratio of loss factor to permeability.
$\tan\delta / \mu_i$ (for materials)
$\tan\delta / \mu_e$ (for cores with gaps in the magnetic circuit)

8. Quality factor, Q / Qualitätsfaktor Q

This is the reciprocal of the loss factor and is given by $Q=1/\tan\delta$

9. Temperature coefficient, α_μ (I/K) / Temperaturkoeffizient, α_μ (I/K)

This is the fractional difference of permeability per 1K in a temperature range of from T_1 to T_2.

$$\alpha_\mu = \frac{\mu_2 - \mu_1}{\mu_1} \cdot \frac{1}{T_2 - T_1} \qquad (T_2 > T_1)$$

Where μ_1 : permeability at temperature T1
μ_2 : permeability at temperature T2

10. Relative temperature coefficient, $\alpha_{\mu r}$ (I/K)

This is the temperature coefficient per unit permability and is given by the following equation:

$$\alpha_\mu = \frac{\mu_2 - \mu_1}{\mu_2{}^2} \cdot \frac{1}{T_2 - T_1} \qquad (T_2 > T_1)$$

11. Curie temperature, Tc / Curie Temperatur, Tc

It is the critical temperature level at which the ferromagnetic state of the material changes to paramagnetic state. (Fig.2)

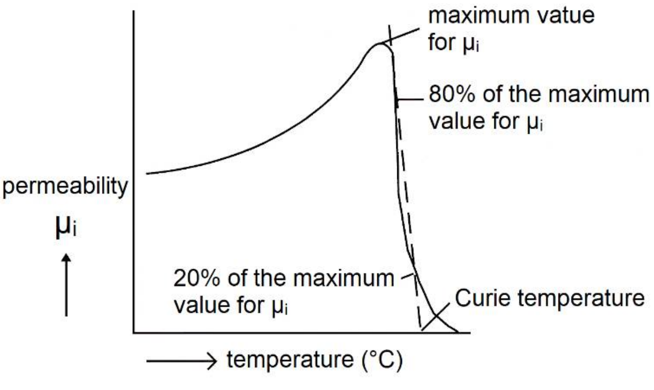

Fig.2

12. Disaccommodation factor, D_F / Disakkomodationsfaktor, D_F

This is the factor representing the variation of permeability through time after a complete demagnetization of the core at a constant temperature.

$$D_F = \frac{\mu_1 - \mu_2}{\log \frac{T_2}{T_1}} \cdot \frac{1}{\mu_1{}^2} \qquad (T_2 > T_1)$$

Where μ_1 : permeability t_1 minutes after complete demagnetization.
μ_2 : permeability t_2 minutes after complete demagnetization.

13. Electrical resistivity, p (Ω/m) / Elektrischer Widerstand, p (Ω/m)

This is the electrical resistance per unit length and cross-sectional area of a magnetic core.

14. Density, d(kg/m^3) / Verlustleistungsdichte, d(kg/m^3)

This is the weight per unit volume of a magnetic core as expressed below:

$$d=W/V$$

Where W: weight of magnetic body (k)
V: volume of magnetic body(m^3)

15. Power loss, Pv (kW/m³ , W/kg) / Verlustleistung, PV (kW/m³ , W/kg)

Power loss denotes the loss by an electrical transformer, such as a switching power supply, under a magnetization condition featuring a high frequenzy and large amplitude. Operating magnetic flux density is given by the following equation.

$$B_m = \frac{E}{4.44 f N A e}$$

Where E: voltage effective value applied to coil
Bm: peak value of magnetic flux density
f: frequency (Hz)
N: number of coil turns
Ae: effective cross-sectional area(m^2)

16. Inductance factor, AL (nH/N²) / Induktivätsfaktor, AL (nH/N²)

This is the inductance per turn of the coil wound around the ferrite cores with definite shape and dimension.

$$A_L = L/N^2$$

Where L: inductance of the coil with ferrite core
N: turns of the coil

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Symbols of common use and definitions

symbol	definition	symbol	definition
A_e	Effective section area	L_e	Effective path length
A_L	Inductance factor	M	Coefficient of inductance
A_w	Window area of coil	N	Number of coil turns
Br	Residual magnetic flux density	n	Turns Ratio
Bs	Saturation magnetic flux density	P	Power
C	Capacitance	Pv	Power loss
D	Dutyfactor	R	Resistance, magnetic resistance
F	Frequency	T	Time, cycle temperature
G	Conductance	U	Voltage
H	Magnetic field strength	V	Volume
π	Circumference ratio	W	Energy
p	Electrical resistivity	Z	Impedance
Hc	Coercivity	Ac	Alternating current
I	Electric current	Dc	Direct current
J	Magnetization strength	lim	Limit
j	Empere density	max	Maximum
k,kw	Window space factor of coil	min	Minimum
L	Self-inductance of core with coil	D	Density
Q	Quality factor	V_e	Effective volume
T_C	Curie temperature	DF	Disaccommodation factor
U_i	Initial permeability	B	Magnetic flux density
U_e	Effective permeability		