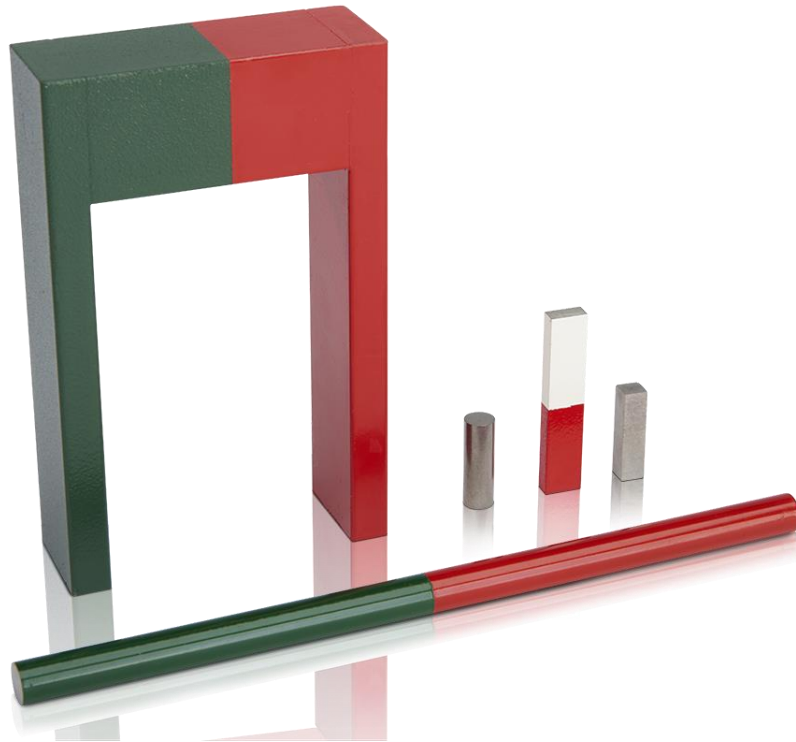


Goudsmit AlNiCo grade system



Introduction

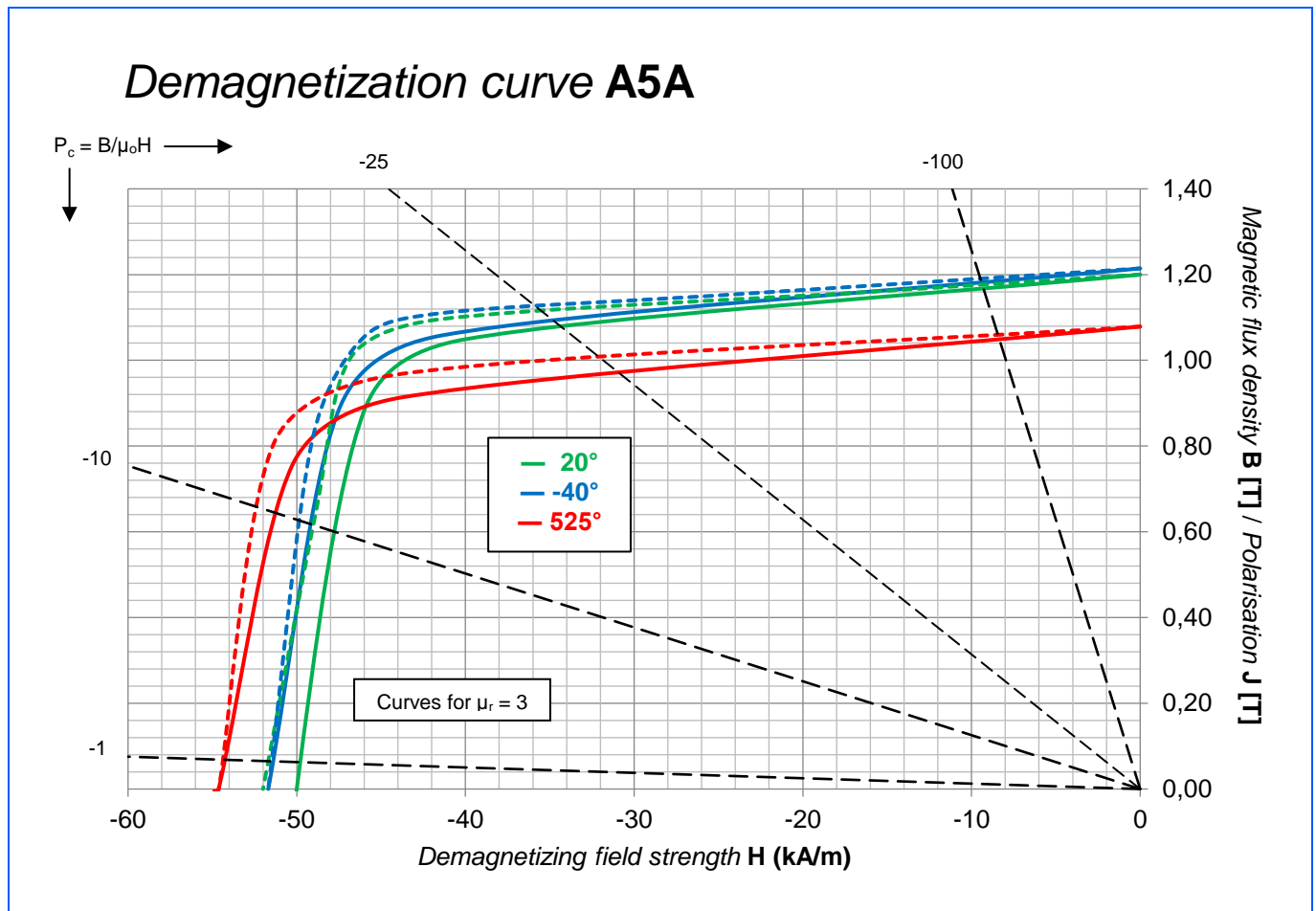
This document provides magnetic, physical and mechanical data of all the aluminium-nickel-cobalt (AlNiCo) magnets Goudsmit sells and which are relevant for the selection of magnets and design of magnetic systems.

AlNiCo grades

Goudsmit grade code	Production type	Remanence B_r	Normal coercivity H_{cB}	Intrinsic coercivity H_{cJ}	Maximum energy product $(BH)_{max}$	Remanence temperature coefficient $\alpha(B_r)$	Intrinsic coercivity temperature coefficient $\beta(H_{cJ})$	Maximum operating temperature T_{max}
		minimum value	minimum value	minimum value	minimum value	minimum typical value	minimum typical value	maximum value
		[mT]	[kA/m]	[kA/m]	[kJ/m ³]	[%/°C]	[%/°C]	[°C]
A5A	Cast	1140	50	52	40	-0.020	0.010	525
A5B	Cast	1188	52	54	44	-0.020	0.010	525
A6	Cast	1235	56	58	52	-0.020	0.030	525
A7	Cast	1283	58	60	60	-0.020	0.030	525
A8A	Cast	760	110	112	38	-0.025	0.010	550
A8B	Cast	855	115	117	44	-0.025	0.010	550
A9A	Cast	950	110	112	60	-0.025	0.010	550
A9B	Cast	1026	120	122	80	-0.025	0.010	550
AS5	Sintered	1093	48	50	34	-0.020	0.010	525
AS6	Sintered	1045	58	60	28	-0.020	0.030	525
AS8	Sintered	760	110	112	38	-0.025	0.010	550

These are the most common grades. Please contact Goudsmit for questions on other grades available at Goudsmit.

Technical datasheet: AlNiCo A5A – Cast



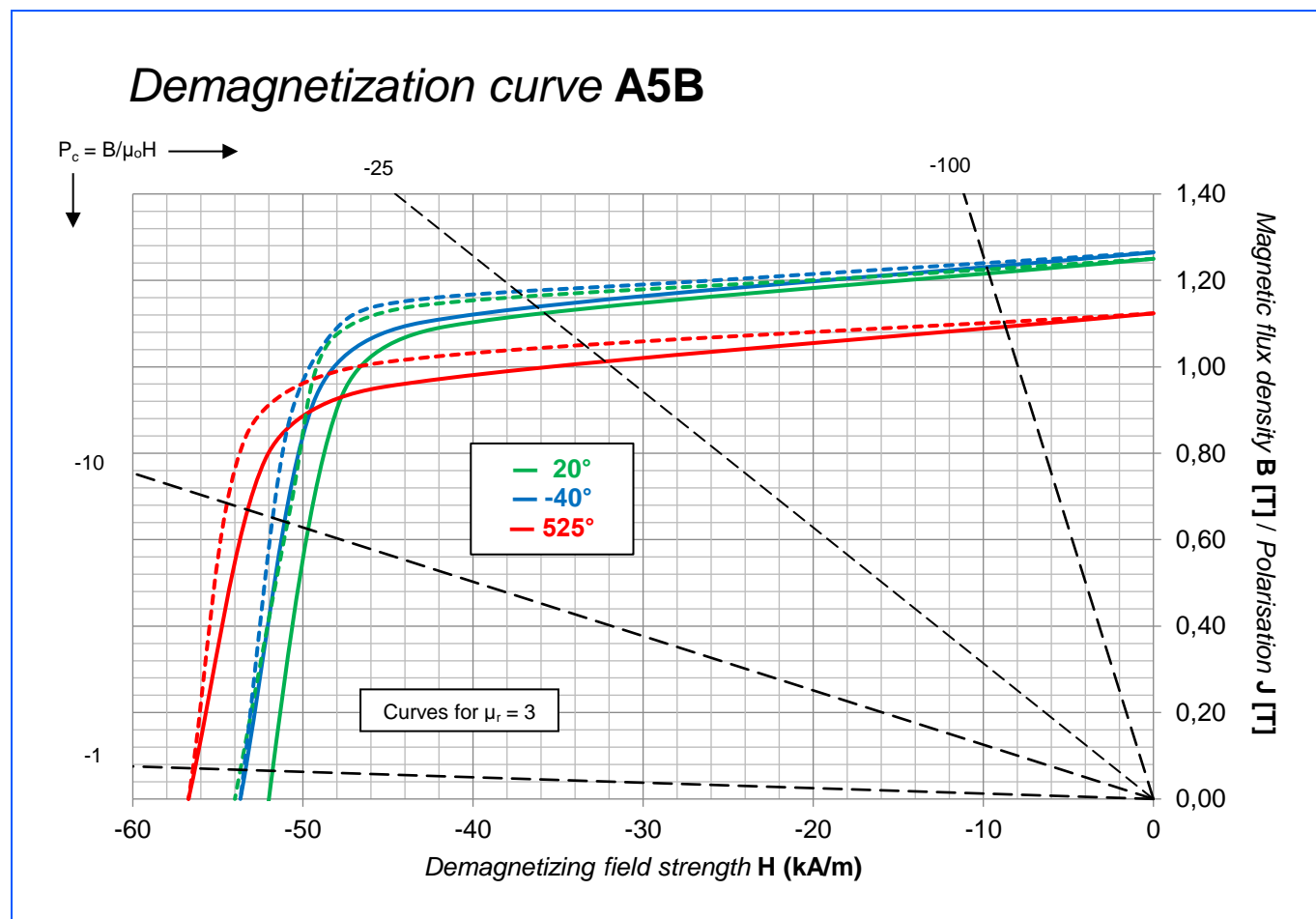
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	1.20	T
H_{cB}	min	50	kA/m
H_{cJ}	min	52	kA/m
$(BH)_{max}$	min	40	kJ/m ³
$\alpha(B_r)$	min typ	-0.020	%/°C
$\beta(H_{cJ})$	min typ	0.010	%/°C
T_{max}		525	°C
μ_r	typ	2.0–3.0	-

Physical & Mechanical properties @20°C			
Density	typ	6900 - 7300	kg/m ³
Vickers Hardness	typ	440 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	48 - 310	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	20 - 160	MPa
Electrical resistivity	typ	0.45-0.75	$\mu\Omega m$
Specific heat capacity	typ	400 - 460	J/(kg K)
Thermal conductivity	typ	10 - 100	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo **A5B** – Cast

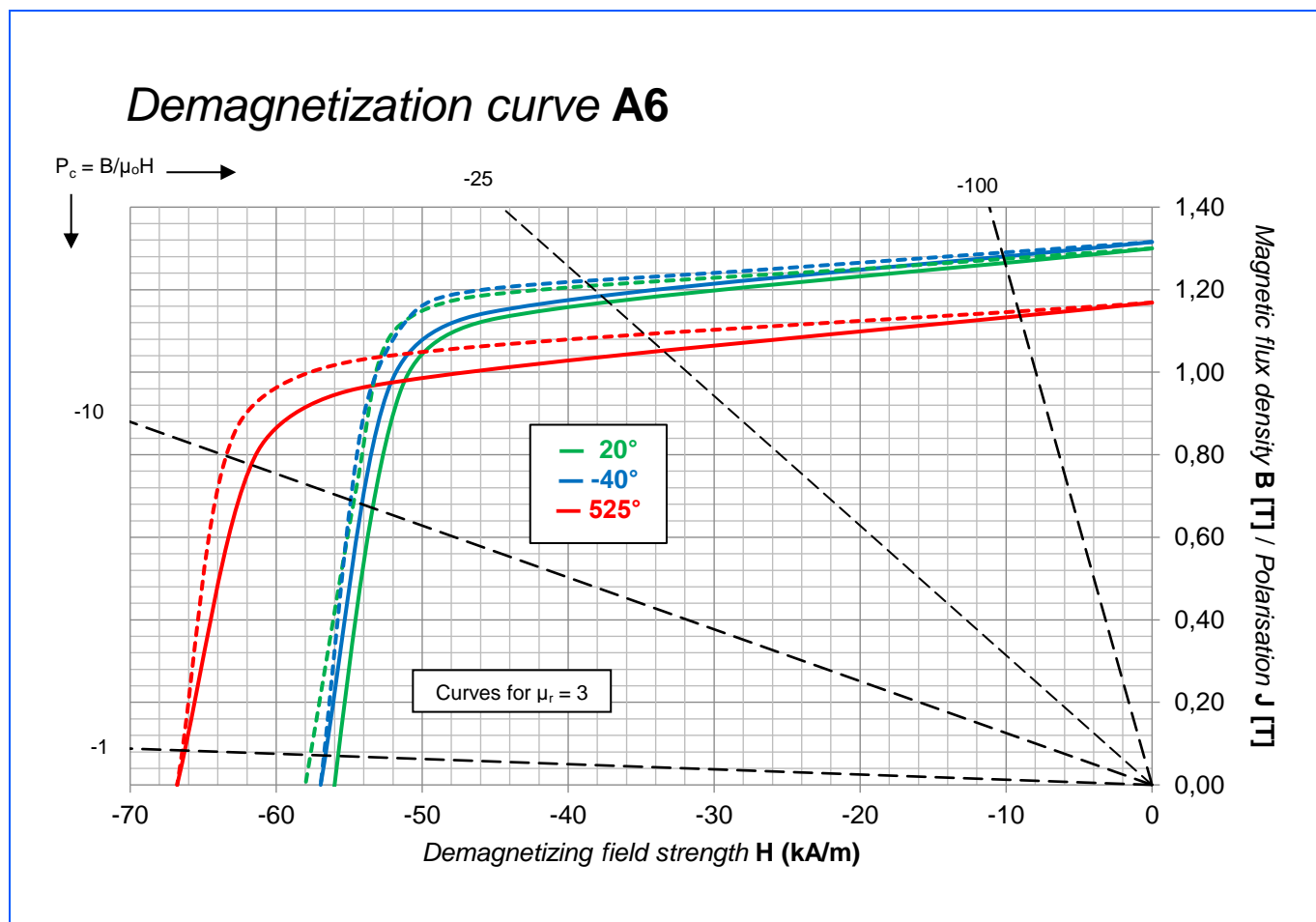


Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C				Physical & Mechanical properties @20°C		
B_r	min	1.25	T	Density	typ	6900 - 7300 kg/m ³
H_{cB}	min	52	kA/m	Vickers Hardness	typ	440 - 700 HV
H_{cJ}	min	54	kA/m	Modulus of Elasticity / Young's modulus	typ	100 - 200 GPa
$(BH)_{max}$	min	44	kJ/m ³	Flexural / bending strength	typ	48 - 310 MPa
$\alpha(B_r)$	min typ	-0.020	%/°C	Compressive strength	typ	300 - 400 MPa
$\beta(H_{cJ})$	min typ	0.010	%/°C	Tensile strength / ultimate strength	typ	20 - 160 MPa
T_{max}		525	°C	Electrical resistivity	typ	0.45-0.75 $\mu\Omega$ m
μ_r	typ	2.0-3.0	-	Specific heat capacity	typ	400 - 460 J/(kg K)
				Thermal conductivity	typ	10 - 100 W/(m K)
				Coefficient of linear thermal expansion, DOM*	typ	11 - 14 $10^{-6}/K$
				Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14 $10^{-6}/K$

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo A6 – Cast

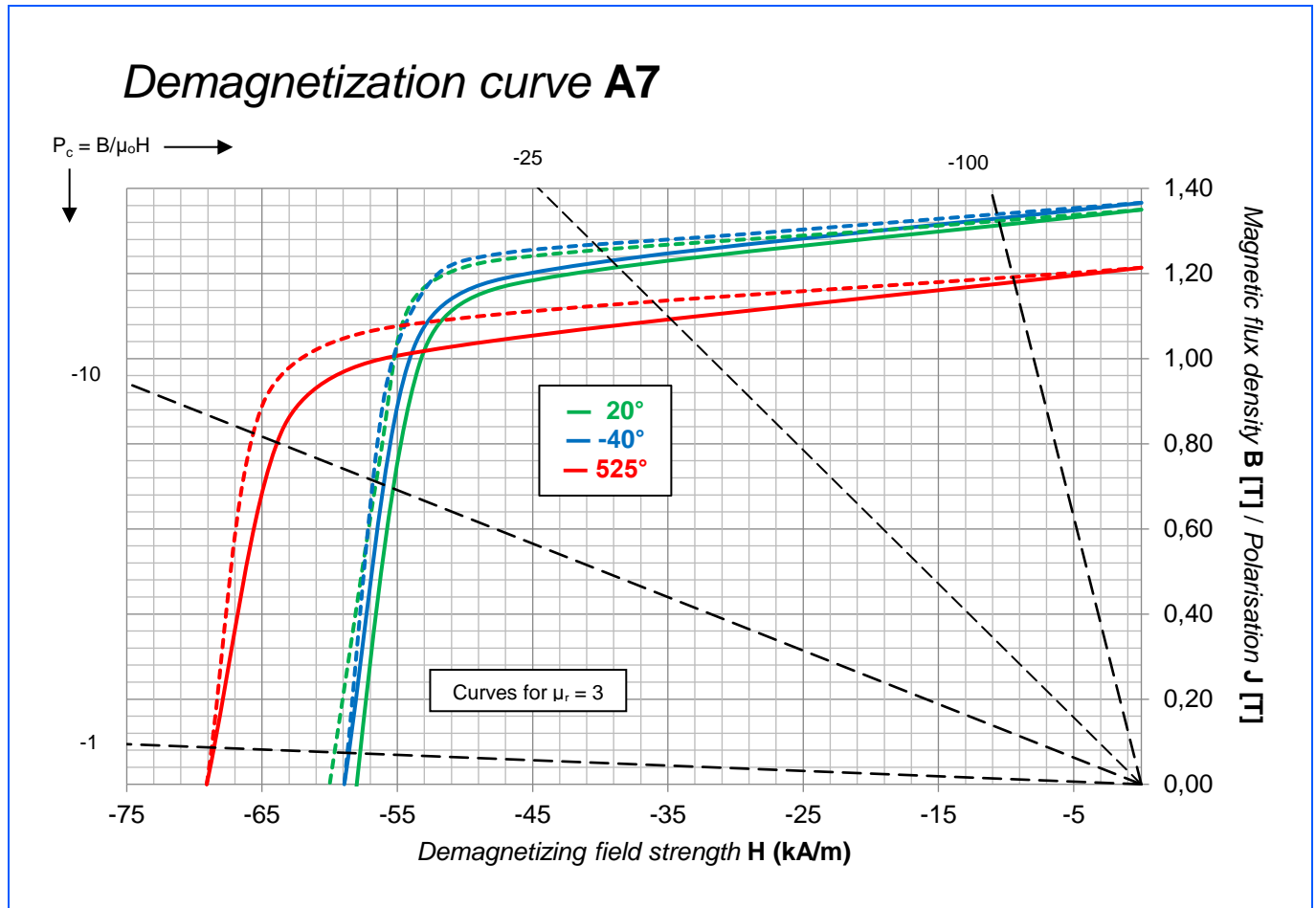


Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C				Physical & Mechanical properties @20°C			
B_r	min	1.30	T	Density	typ	6900 - 7300	kg/m ³
H_{cB}	min	56	kA/m	Vickers Hardness	typ	440 - 700	HV
H_{cJ}	min	58	kA/m	Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
$(BH)_{max}$	min	52	kJ/m ³	Flexural / bending strength	typ	48 - 310	MPa
$\alpha(B_r)$	min typ	-0.020	%/°C	Compressive strength	typ	300 - 400	MPa
$\beta(H_{cJ})$	min typ	0.030	%/°C	Tensile strength / ultimate strength	typ	20 - 160	MPa
T_{max}		525	°C	Electrical resistivity	typ	0.45-0.75	$\mu\Omega m$
μ_r	typ	2.0-3.0	-	Specific heat capacity	typ	400 - 460	J/(kg K)
				Thermal conductivity	typ	10 - 100	W/(m K)
				Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
				Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo A7 – Cast



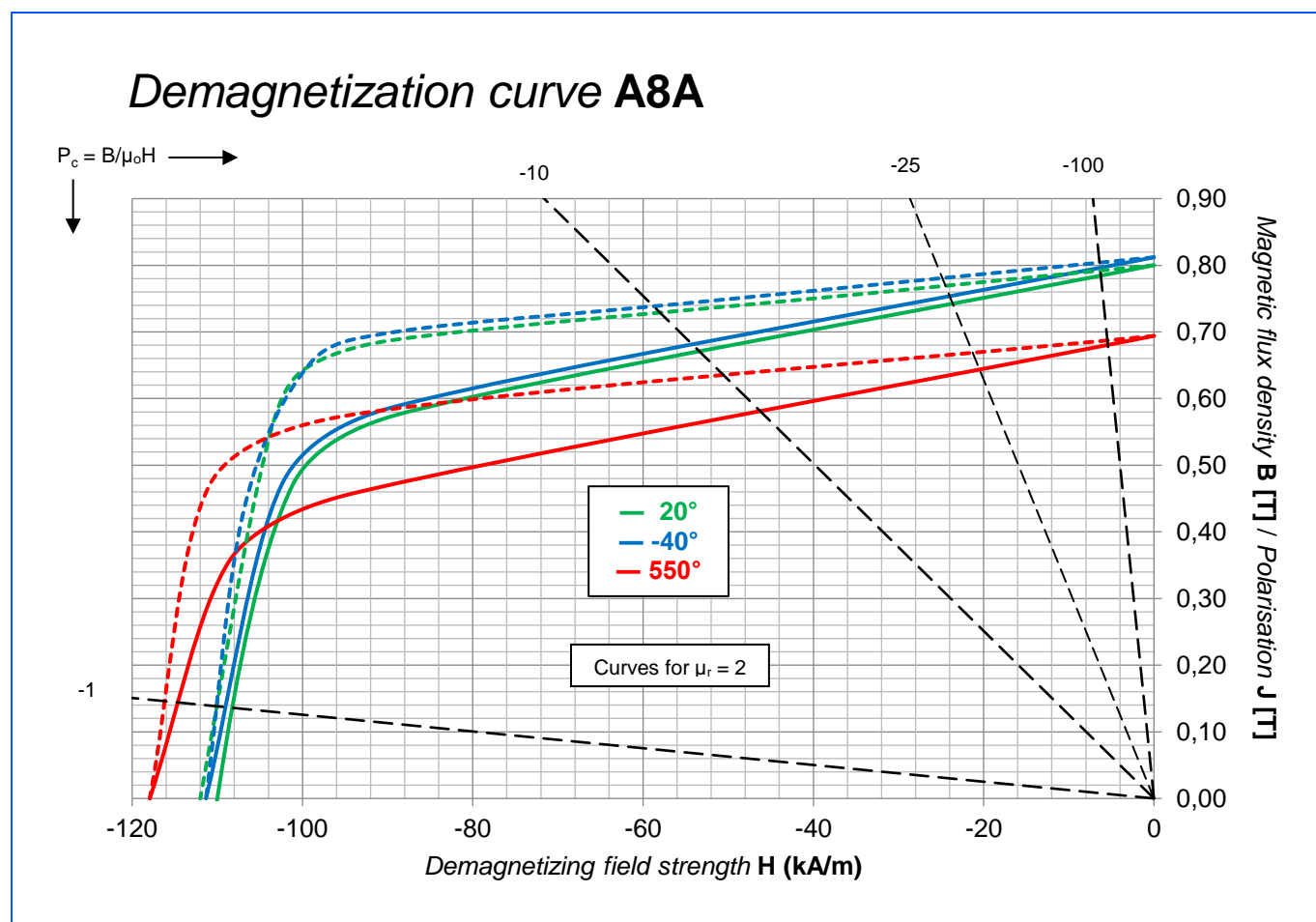
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	1.35	T
H_{cB}	min	58	kA/m
H_{cJ}	min	60	kA/m
$(BH)_{max}$	min	60	kJ/m ³
$\alpha(B_r)$	min typ	-0.020	%/°C
$\beta(H_{cJ})$	min typ	0.030	%/°C
T_{max}		525	°C
μ_r	typ	2.0–3.0	-

Physical & Mechanical properties @20°C			
Density	typ	6900 - 7300	kg/m ³
Vickers Hardness	typ	440 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	48 - 310	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	20 - 160	MPa
Electrical resistivity	typ	0.45-0.75	$\mu\Omega m$
Specific heat capacity	typ	400 - 460	J/(kg K)
Thermal conductivity	typ	10 - 100	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo A8A – Cast



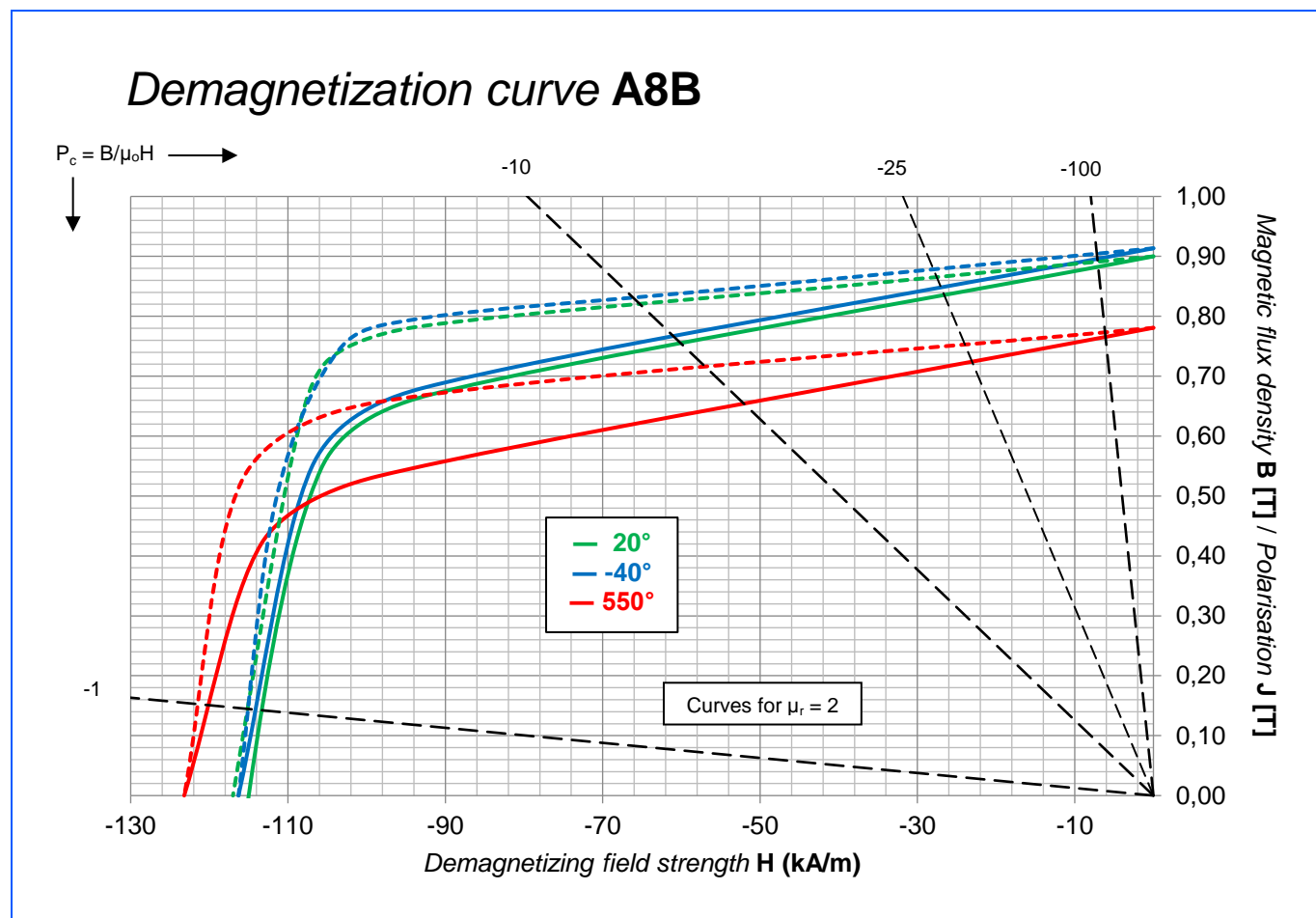
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	0.80	T
H_{cB}	min	110	kA/m
H_{cJ}	min	112	kA/m
$(BH)_{max}$	min	38	kJ/m ³
$\alpha(B_r)$	min typ	-0.025	%/°C
$\beta(H_{cJ})$	min typ	0.010	%/°C
T_{max}		550	°C
μ_r	typ	2.0–3.0	-

Physical & Mechanical properties @20°C			
Density	typ	6900 - 7300	kg/m ³
Vickers Hardness	typ	440 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	48 - 310	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	20 - 160	MPa
Electrical resistivity	typ	0.45-0.75	$\mu\Omega m$
Specific heat capacity	typ	400 - 460	J/(kg K)
Thermal conductivity	typ	10 - 100	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo A8B – Cast



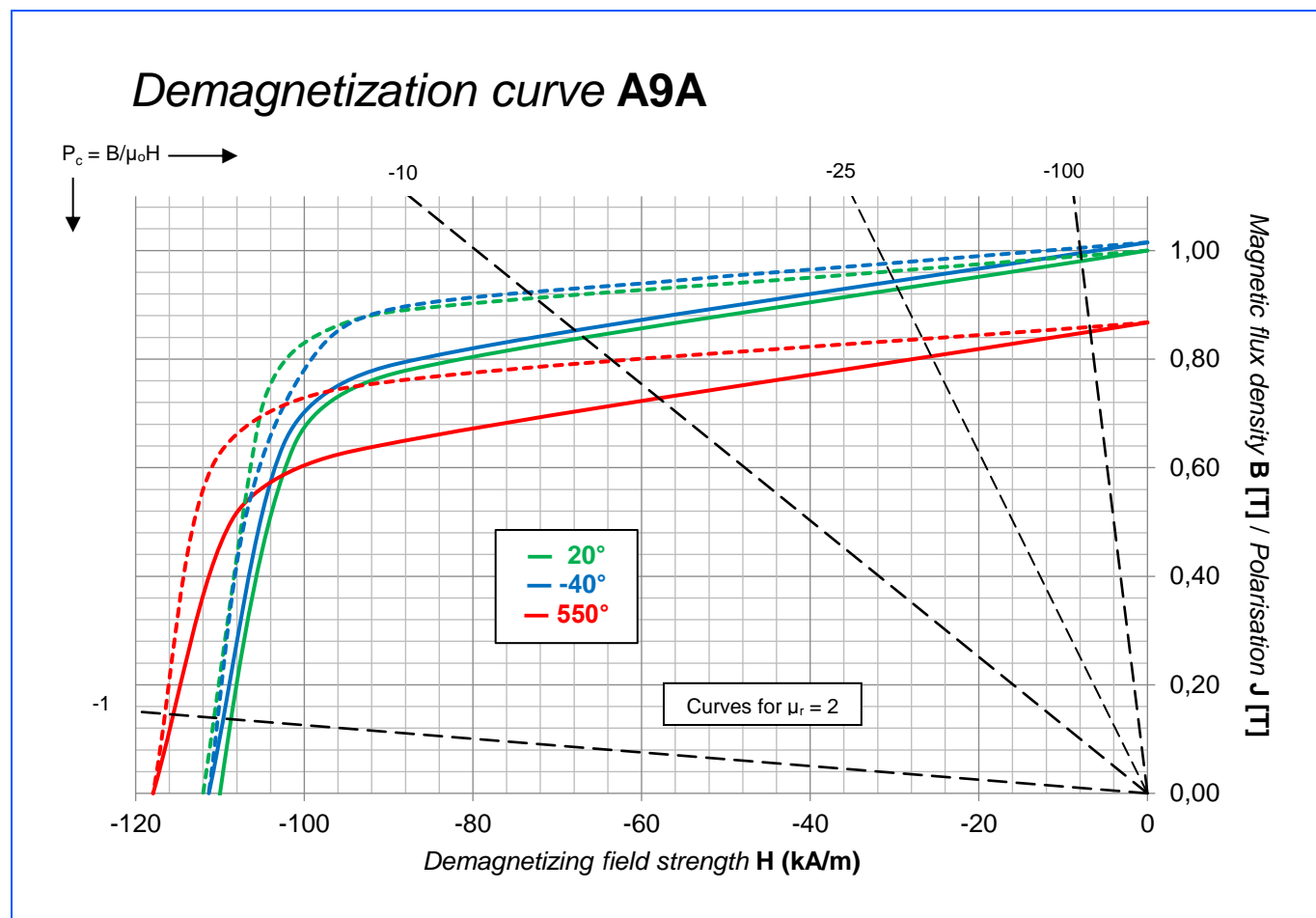
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	0.90	T
H_{cB}	min	115	kA/m
H_{cJ}	min	117	kA/m
$(BH)_{max}$	min	44	kJ/m ³
$\alpha(B_r)$	min typ	-0.025	%/°C
$\beta(H_{cJ})$	min typ	0.010	%/°C
T_{max}		550	°C
μ_r	typ	2.0–3.0	-

Physical & Mechanical properties @20°C			
Density	typ	6900 - 7300	kg/m ³
Vickers Hardness	typ	440 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	48 - 310	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	20 - 160	MPa
Electrical resistivity	typ	0.45-0.75	$\mu\Omega$ m
Specific heat capacity	typ	400 - 460	J/(kg K)
Thermal conductivity	typ	10 - 100	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo **A9A** – Cast



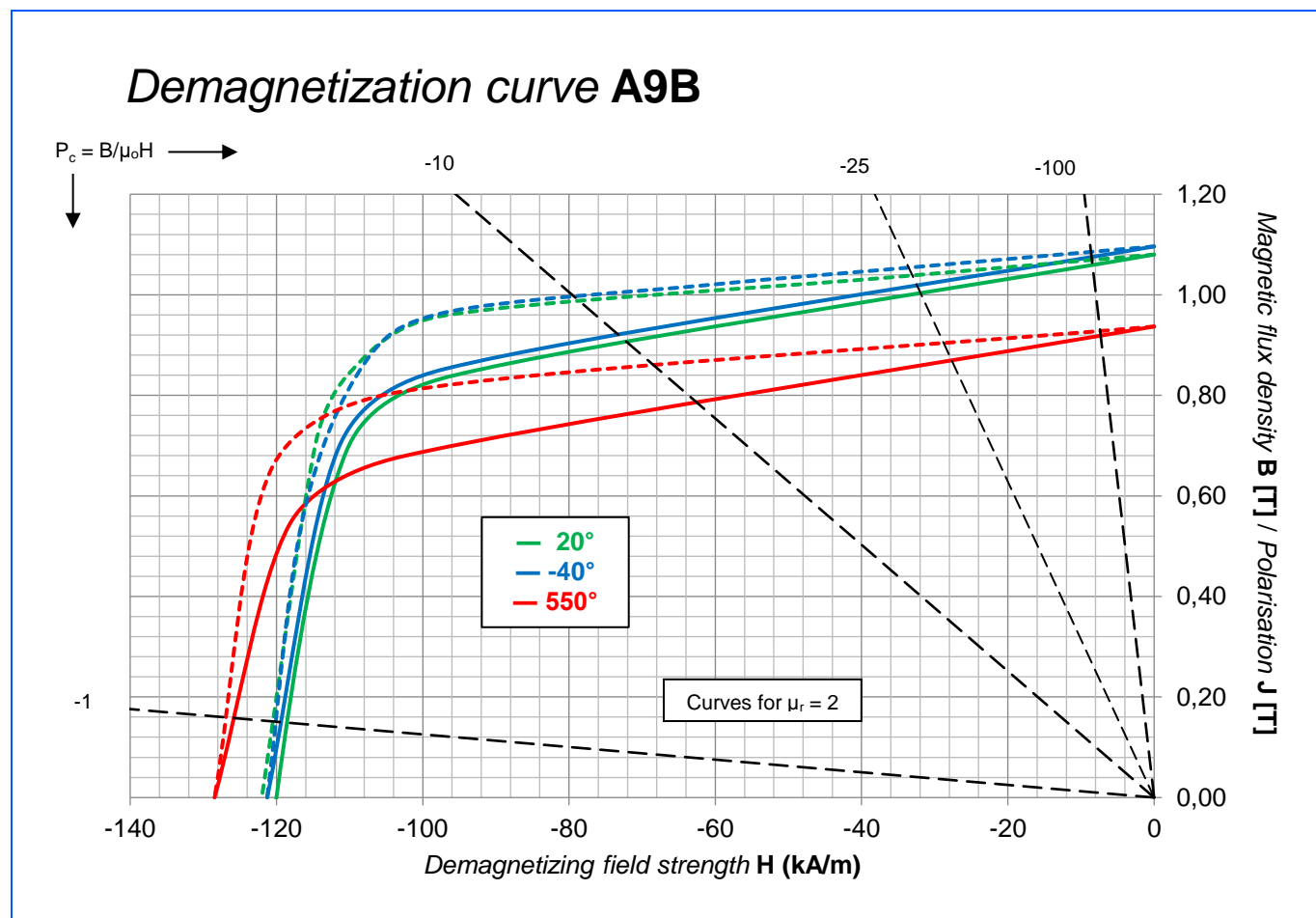
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	1.00	T
H_{cB}	min	110	kA/m
H_{cJ}	min	112	kA/m
$(BH)_{max}$	min	60	kJ/m ³
$\alpha(B_r)$	min typ	-0.025	%/°C
$\beta(H_{cJ})$	min typ	0.010	%/°C
T_{max}		550	°C
μ_r	typ	2.0–3.0	-

Physical & Mechanical properties @20°C			
Density	typ	6900 - 7300	kg/m ³
Vickers Hardness	typ	440 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	48 - 310	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	20 - 160	MPa
Electrical resistivity	typ	0.45-0.75	$\mu\Omega\text{m}$
Specific heat capacity	typ	400 - 460	J/(kg K)
Thermal conductivity	typ	10 - 100	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo **A9B** – Cast

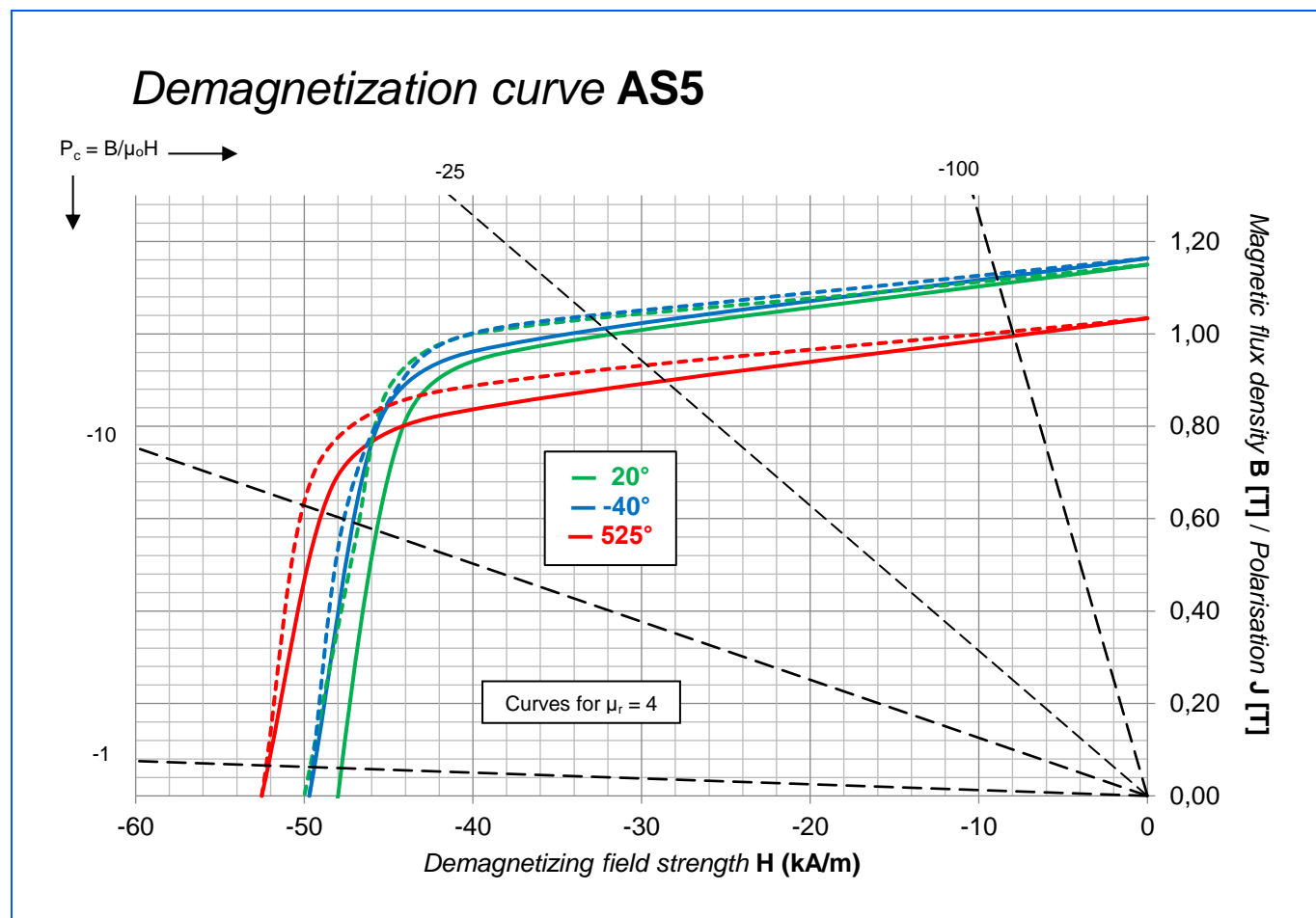


Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C				Physical & Mechanical properties @20°C			
B_r	min	1.08	T	Density	typ	6900 - 7300	kg/m ³
H_{cB}	min	120	kA/m	Vickers Hardness	typ	440 - 700	HV
H_{cJ}	min	122	kA/m	Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
$(BH)_{max}$	min	80	kJ/m ³	Flexural / bending strength	typ	48 - 310	MPa
$\alpha(B_r)$	min typ	-0.025	%/°C	Compressive strength	typ	300 - 400	MPa
$\beta(H_{cJ})$	min typ	0.010	%/°C	Tensile strength / ultimate strength	typ	20 - 160	MPa
T_{max}		550	°C	Electrical resistivity	typ	0.45-0.75	$\mu\Omega m$
μ_r	typ	2.0-3.0	-	Specific heat capacity	typ	400 - 460	J/(kg K)
				Thermal conductivity	typ	10 - 100	W/(m K)
				Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
				Coefficient of linear thermal expansion, \perp DOM*	typ	11 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo AS5 – Sintered



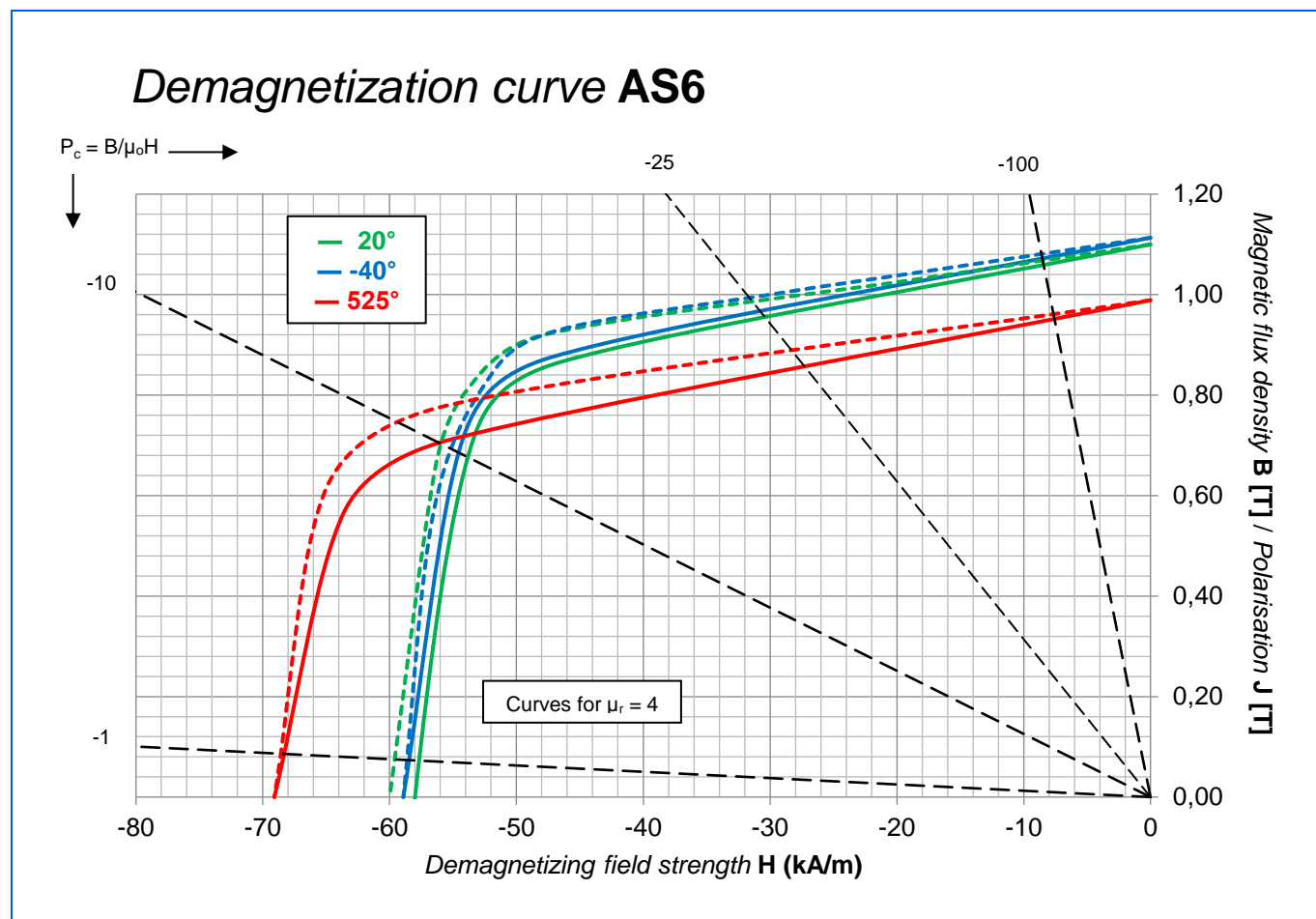
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	1.15	T
H_{cB}	min	48	kA/m
H_{cJ}	min	50	kA/m
$(BH)_{max}$	min	34	kJ/m ³
$\alpha(B_r)$	min typ	-0.020	%/°C
$\beta(H_{cJ})$	min typ	0.010	%/°C
T_{max}		525	°C
μ_r	typ	3.0–4.5	-

Physical & Mechanical properties @20°C			
Density	typ	6800 - 7300	kg/m ³
Vickers Hardness	typ	300 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	80 - 760	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	80 - 450	MPa
Electrical resistivity	typ	0.40-0.70	$\mu\Omega m$
Specific heat capacity	typ	350 - 500	J/(kg K)
Thermal conductivity	typ	10 - 200	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	10 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo AS6 – Sintered



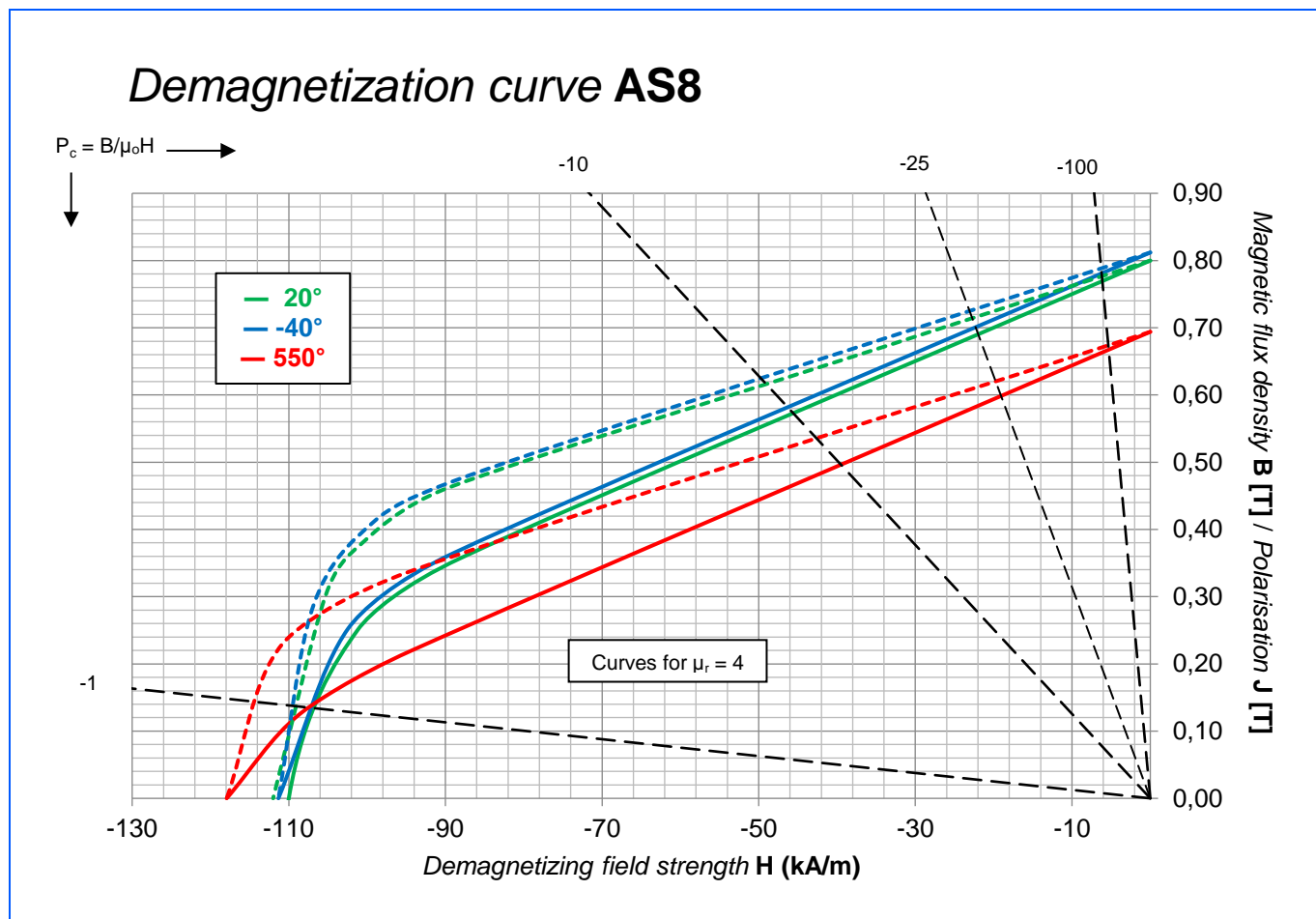
Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	1.10	T
H_{cB}	min	58	kA/m
H_{cJ}	min	60	kA/m
$(BH)_{max}$	min	28	kJ/m ³
$\alpha(B_r)$	min typ	-0.020	%/°C
$\beta(H_{cJ})$	min typ	0.030	%/°C
T_{max}		525	°C
μ_r	typ	3.0–4.5	-

Physical & Mechanical properties @20°C			
Density	typ	6800 - 7300	kg/m ³
Vickers Hardness	typ	300 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	80 - 760	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	80 - 450	MPa
Electrical resistivity	typ	0.40-0.70	$\mu\Omega\text{m}$
Specific heat capacity	typ	350 - 500	J/(kg K)
Thermal conductivity	typ	10 - 200	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, \perp DOM*	typ	10 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization

Technical datasheet: AlNiCo AS8 – Sintered

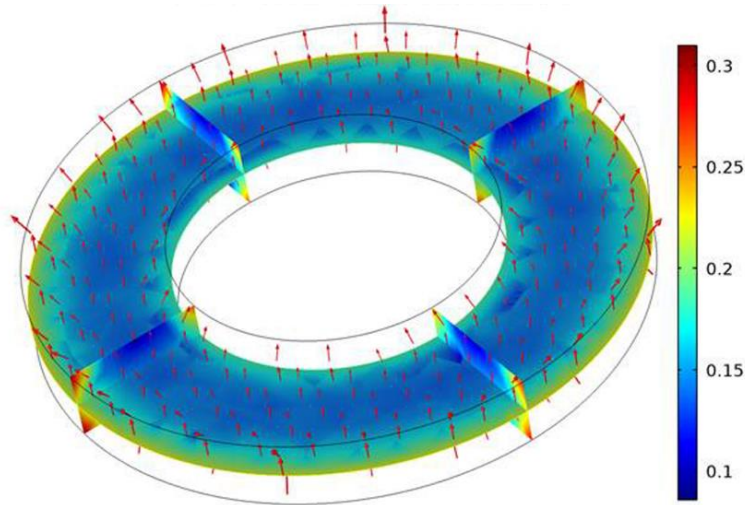


Solid lines represent magnetic flux densities. Dashed lines represent polarisations. The curves here are estimates obtained from data available from the current Goudsmit grade system (Available on the website. See also the magnetic properties below). On request, actual measurements of demagnetization curves can be obtained. For that, contact us on the address below.

Magnetic properties @20°C			
B_r	min	0.80	T
H_{cB}	min	110	kA/m
H_{cJ}	min	112	kA/m
$(BH)_{max}$	min	38	kJ/m ³
$\alpha(B_r)$	min typ	-0.025	%/°C
$\beta(H_{cJ})$	min typ	0.010	%/°C
T_{max}		550	°C
μ_r	typ	3.0–4.5	-

Physical & Mechanical properties @20°C			
Density	typ	6800 - 7300	kg/m ³
Vickers Hardness	typ	300 - 700	HV
Modulus of Elasticity / Young's modulus	typ	100 - 200	GPa
Flexural / bending strength	typ	80 - 760	MPa
Compressive strength	typ	300 - 400	MPa
Tensile strength / ultimate strength	typ	80 - 450	MPa
Electrical resistivity	typ	0.40-0.70	$\mu\Omega m$
Specific heat capacity	typ	350 - 500	J/(kg K)
Thermal conductivity	typ	10 - 200	W/(m K)
Coefficient of linear thermal expansion, DOM*	typ	11 - 14	10 ⁻⁶ /K
Coefficient of linear thermal expansion, ⊥ DOM*	typ	10 - 14	10 ⁻⁶ /K

* DOM = Direction Of Magnetization



Goudsmit offers a wide range of services with regards to the design and selection of the appropriate magnet for your specific application. For instance, we apply magnet calculations and FEM simulations to quickly identify the best magnet for your product. In addition, we have all the necessary processes in place to supply the automotive and aerospace industries, including IATF16949 and AS9120 certifications.

The possibilities with magnet technology are endless, which is why it can quickly become confusing. Goudsmit has more than 60 years of experience in the world of magnetism and is happy to help you with advice and a range of services:

- FEM simulation & magnet calculations: gain quick insight into the operation of your design.
- Prototyping & samples: tangible magnet technology based on your requirements.
- Engineering: development of magnet assemblies and components.
- Quality control: critical properties tested and validated in our own measurement lab.
- Certification: ISO9001, IATF16949 or AS9120 for your industry.
- Stock management service: delivery of your magnets on demand through our modern warehouse.

You can choose whatever form of support you want. This guarantees you the right magnet for your specific application.

