



## **Soft Magnetic Materials for DC-applications**

# Soft Magnetic Materials for DC-applications

High-purity iron and iron-phosphorous alloys are currently among the most common commercially available sintered soft magnetic materials for direct current (DC) and low-frequency applications.

ASC100.29 is an atomized powder with very high compressibility often used as base material for soft magnetic applications. In order to improve the soft magnetic properties (low  $H_c$ , high  $\mu_{max}$ ), phosphorous is typically added to high-purity iron powder in the range 0.45 wt.% - 0.8 wt.% as finely divided  $Fe_3P$  particles.

## Sintered iron materials

		Compaction pressure [MPa]		392		589		785	
ASC100.29 +0,6% Kenolube	Sintering atmosphere		DA	H <sub>2</sub>	DA	H <sub>2</sub>	DA	H <sub>2</sub>	
	Density [g/cm <sup>3</sup> ]		6,7	6,7	7,1	7,1	7,3	7,3	
	B <sub>max</sub> @1200 A/m [T]		1,01	1,03	1,21	1,22	1,32	1,32	
	B <sub>r</sub> [T]		0,84	0,91	1,05	1,11	1,17	1,20	
	H <sub>c</sub> [A/m]		155	130	145	125	135	120	
	μ <sub>max</sub>		2100	2600	2800	3400	3300	3800	
MPIF standard [1]	<b>MPIF material</b>	<b>Designation code</b>	<b>FF-0000-20U</b>		<b>FF-0000-20X</b>		<b>FF-0000-20X</b>		
	<b>Mandatory values</b>	Minimum density [g/cm <sup>3</sup> ]	6,5		7,1		7,1		
		Maximum H <sub>c</sub> [A/m]	160		160		160		
	<b>Typical values</b>	B <sub>max</sub> @1200 A/m [T]	0,95		1,20		1,20		
		B <sub>r</sub> [T]	0,82		1,10		1,10		
	μ <sub>max</sub>	1800		2900		2900			

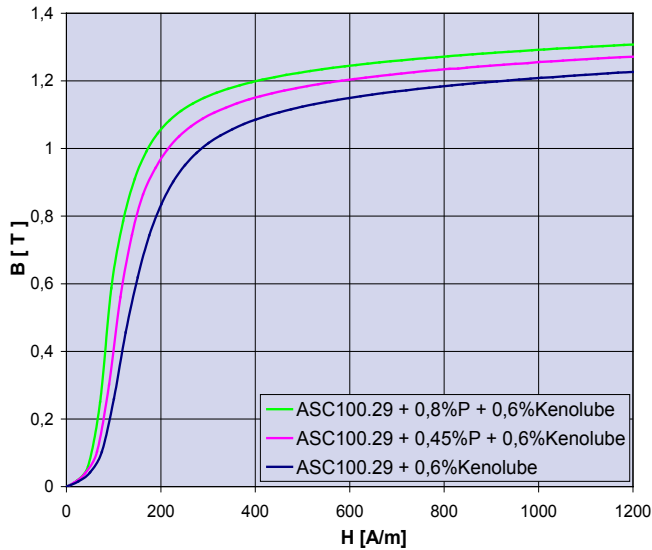
## Sintered iron-phosphorus materials

		Compaction pressure [MPa]		392		589		785	
ASC100.29 + 0,45% P +0,6% Kenolube	Sintering atmosphere		DA	H <sub>2</sub>	DA	H <sub>2</sub>	DA	H <sub>2</sub>	
	Density [g/cm <sup>3</sup> ]		6,7	6,7	7,1	7,1	7,3	7,3	
	B <sub>max</sub> @1200 A/m [T]		1,07	1,11	1,25	1,27	1,33	1,36	
	B <sub>r</sub> [T]		0,91	0,98	1,10	1,15	1,15	1,24	
	H <sub>c</sub> [A/m]		130	110	125	110	125	105	
	μ <sub>max</sub>		2700	3500	3400	4300	3400	4700	
MPIF standard [1]	<b>MPIF material</b>	<b>Designation code</b>	<b>FY-4500-20V</b>		<b>FY-4500-17X</b>		<b>FY-4500-17Y</b>		
	<b>Mandatory values</b>	Minimum density [g/cm <sup>3</sup> ]	6,7		7,1		7,3		
		Maximum H <sub>c</sub> [A/m]	160		135		135		
	<b>Typical values</b>	B <sub>max</sub> @1200 A/m [T]	1,05		1,25		1,35		
		B <sub>r</sub> [T]	0,85		1,00		1,10		
	μ <sub>max</sub>	2300		3200		3600			

		Compaction pressure [MPa]		392		589		785	
ASC100.29 + 0,8% P +0,6% Kenolube	Sintering atmosphere		DA	H <sub>2</sub>	DA	H <sub>2</sub>	DA	H <sub>2</sub>	
	Density [g/cm <sup>3</sup> ]		6,7	6,8	7,1	7,1	7,3	7,3	
	B <sub>max</sub> @1200 A/m [T]		1,09	1,15	1,27	1,31	1,36	1,38	
	B <sub>r</sub> [T]		0,94	1,02	1,14	1,19	1,21	1,27	
	H <sub>c</sub> [A/m]		115	100	105	95	105	95	
	μ <sub>max</sub>		3100	4200	4100	5100	4200	5600	
MPIF standard [1]	<b>MPIF material</b>	<b>Designation code</b>	<b>FY-8000-17V</b>		<b>FY-8000-15X</b>		<b>FY-8000-15Y</b>		
	<b>Mandatory values</b>	Minimum density [g/cm <sup>3</sup> ]	6,7		7,1		7,3		
		Maximum H <sub>c</sub> [A/m]	135		120		120		
	<b>Typical values</b>	B <sub>max</sub> @1200 A/m [T]	1,10		1,30		1,35		
		B <sub>r</sub> [T]	1,00		1,15		1,30		
	μ <sub>max</sub>	3500		4500		5000			

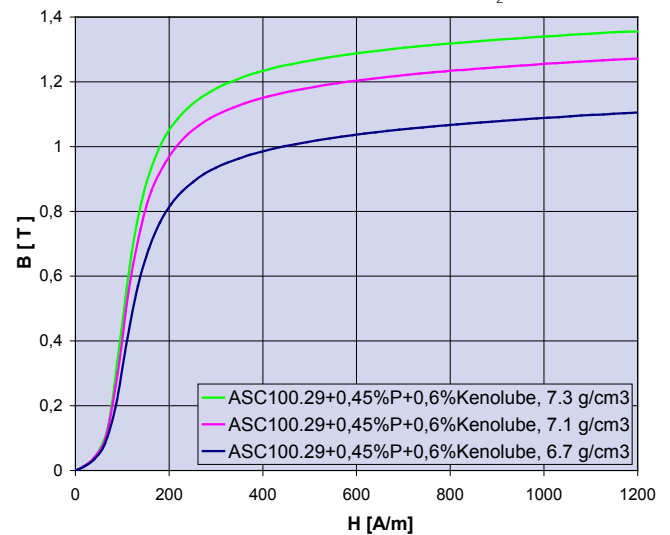
## The effect of phosphorous content

7.1 g/cm<sup>3</sup>, sintering 1150°C, 40 min in H<sub>2</sub>



## The effect of density

ASC100.29+0,45% P+0,6% Kenolube,  
sintering 1150°C, 40 min in H<sub>2</sub>

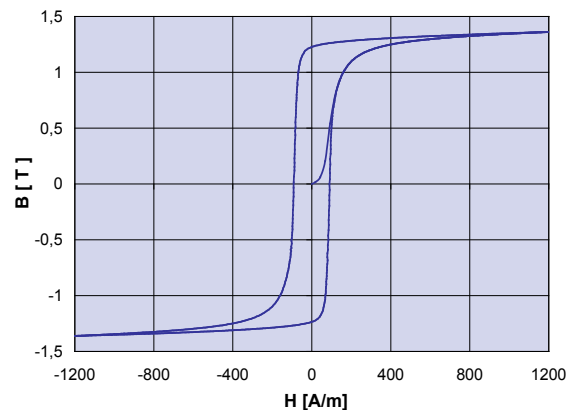


Structure-sensitive magnetic properties such as coercivity and permeability are strongly affected by interstitial elements. Purity of the powder and sintering conditions therefore determine the final soft magnetic properties of the material.

ABC100.30 is an atomized powder with outstanding chemical purity and compressibility. The combination of ABC100.30 and optimized processing results in increased soft magnetic performance for demanding applications.

## Hysteresis curve

ABC100.30 + 0,45% P + 0,6% Kenolube,  
785 MPa, sintering 1150°C, 40 min in H<sub>2</sub>



	ABC100.30 + 0,45% P +0,6% Kenolube		
Sintering	1150°C, 40 min, H <sub>2</sub>		
Compaction pressure [MPa]	392	589	785
Density [g/cm <sup>3</sup> ]	6,7	7,1	7,3
B <sub>max</sub> @1200 A/m [T]	1,11	1,25	1,36
B <sub>r</sub> [T]	0,98	1,12	1,24
H <sub>c</sub> [A/m]	95	95	90
μ <sub>max</sub>	4000	4700	5300

<sup>[1]</sup> Soft Magnetic Alloys, Material Standards for PM Structural Parts (MPIF Standard 35), 2007 Edition, pp.56-57.

MANUFACTURING CONDITIONS: Compaction at 392, 589 or 785 MPa of toroids (55/45 x 5 mm).  
Sintering: 1120°C, 30 min in synthetic DA or 1150°C, 40 min in pure H<sub>2</sub>.

# Power of Powder

Metal powder offers entirely new possibilities to create more effective, lighter products with a reduced environmental impact. By combining the right alloy with a suitable morphology of the powder grains, new opportunities open up to match your challenges. Contact us and together we will release the power.

Metal powders are traditionally used to manufacture sintered components for vehicles. But there is a lot more to them. By fortifying food with elemental iron, anaemia can be reduced. By coating with nickel, glass bottle production life is prolonged with wear and temperature resistance. By employing new iron based powders, high temperature brazing of heat exchangers is possible. By utilising the three dimensional magnetic flux of encapsulated metal powders, smaller electrical motors can now be produced. And so on.

In fact, the possibilities of metal powder technology are almost endless. To take advantage of the inherent Power of Powder, please contact your nearest Höganäs office.



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