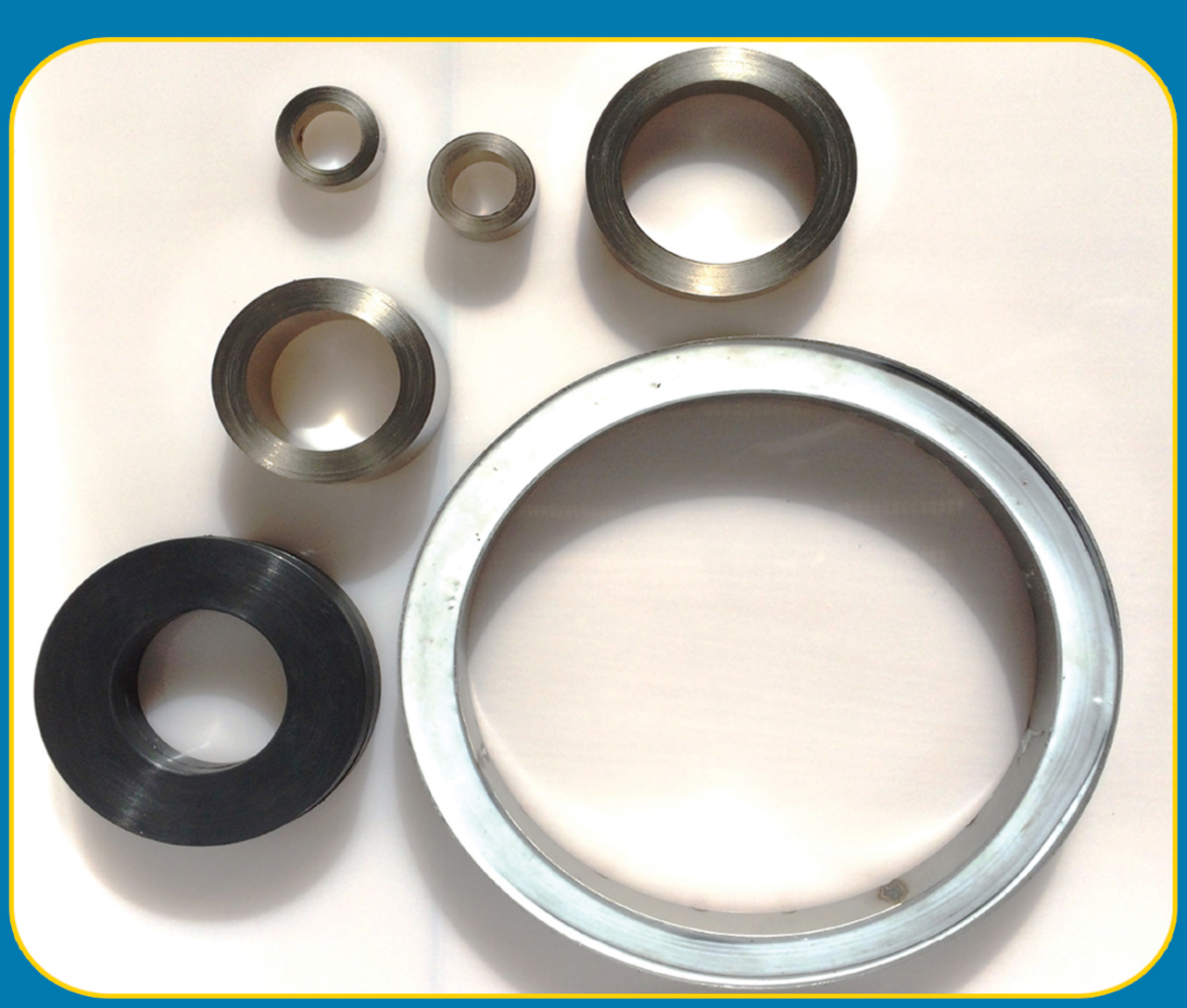
Nanocrystalline Toroidal Cores

A VIABLE ALTERNATIVE TO NICKEL–IRON FOR MANY APPLICATIONS



The discovery of nanocrystalline soft-magnetic materials was announced in the late 1980s, since when considerable interest has been evident.

The properties of nanocrystalline alloys present a unique combination of low core losses and high permeability achieved by NiFe alloys and cobalt based amorphous alloys (such as used in Wiltan's 'Logicor' range of toroids), but with a saturation induction much higher than either of these materials can offer.

The increasing requirement for high accuracy CT's, at an affordable price, has resulted in an increased demand for nanocrystalline as an alternative to 80% NiFe. In many cases it is required , not just as an alternative to NiFe but as a preference due to improved performance.

Nanocrystalline cores offer better performance than NiFe cores, both in permeability throughout the B/H curve and also higher saturation induction. With respect to silicon iron the saturation induction is lower but due to the chemistry and thickness, of the strip, the power loss is also much lower.

Composite cores of nanocrystalline and standard silicon steel can be produced combining very good low signal performance with wide dynamic range.

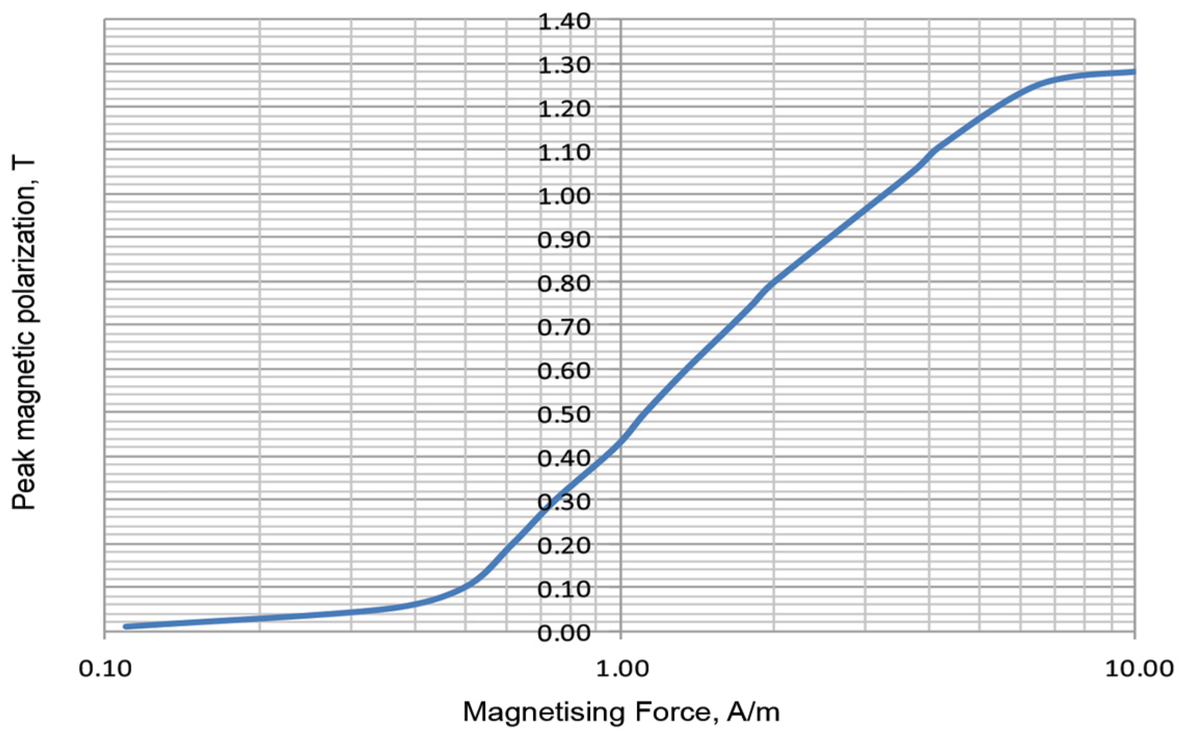
Wiltan can also produce custom shaped cores to the customer's requirements – oval, stadium, rectangular and 'D' – shaped etc. Each shape and size can be designed specifically in collaboration with our technical department to satisfy customer individual needs.

Wiltan Ambassador Buildings Pontnewynydd Industrial Estate Pontypool Torfaen NP4 6YW
T. +44 (0)1495 750 711 F. +44 (0)1495 753 730 sales@wiltan.co.uk www.wiltan.co.uk

Nanocrystalline Toroidal Cores

TECHNICAL PROPERTIES

Saturation Induction (T)	1.25	Hardness Hv (kg/mm²)	880
Curie Temperature Tc (ºC)	560	Density (gm/cc)	7,2
Crystallization Temperature Tx(ºC)	510	Resistivity ρ ($\mu\Omega$.cm)	130
Saturation Magnetostrication λs	2 x 10E-6	Strip thickness (micron))	18-25
Initial Magnetic Permeability μi((GS/Oe)	>8x10E+4	Working temperature (ºC)	-50 to+130
Maximum Permeability μm(Gs/Oe)	>20x10E+4		
Remanence Br(T)	0.6 – 0.7	**Composition**	
Coercivity Hc(A/m)	< 0.8	Iron (Fe)	73.5%
Core loss (20kHz, 0.5T)	< 25	Silicon (Si)	13.5%
Core loss (100kKz, 0.3T)	< 150	Boron (B)	9%
Loss variation (-55 to +125ºC	<15%	Copper (Cu)	1%
Stacking factor	Circa 0.78	Niobium (Nb)	3%



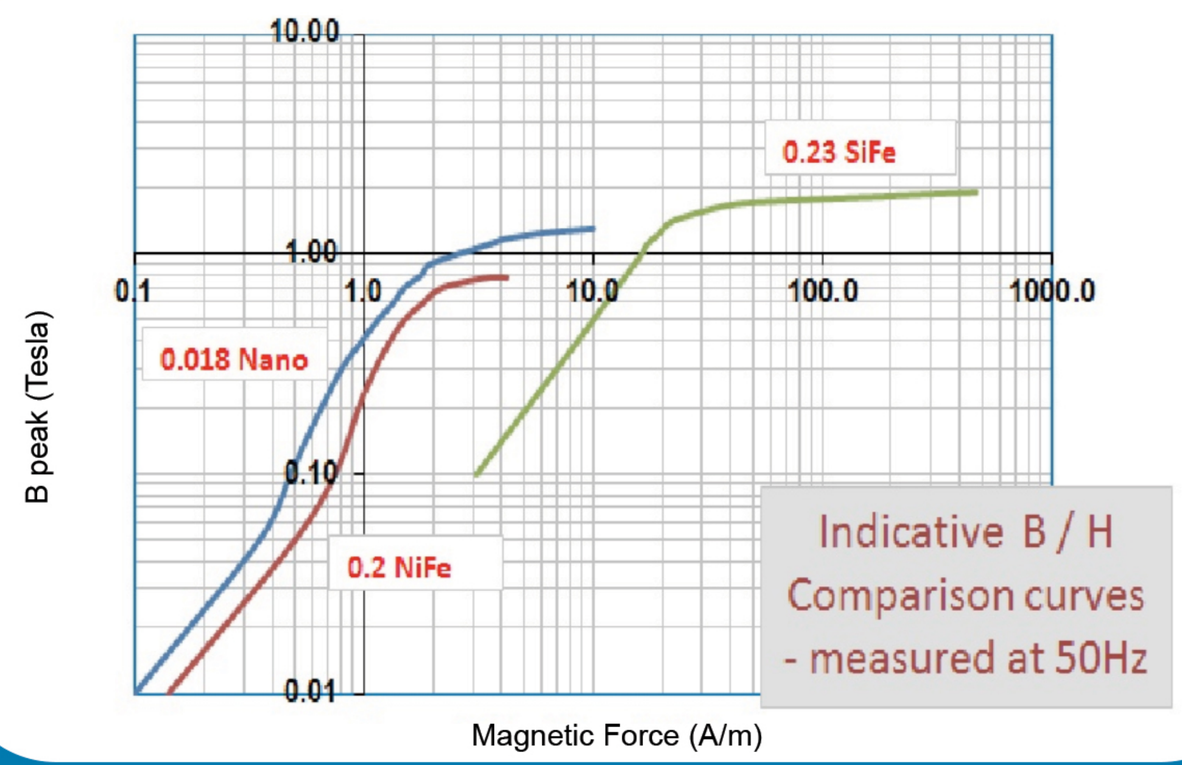
Typical AC Magnetization curve for Nanocrystalline (73% Fe-15% Si-B-Cu-Nb)

Peak magnetic polarization v Magetising Force

Frequency = 50 Hz.

Indicative B/H Comparison Curves for 0.018mm Nano, 0.2mm Nife and 0.23mm Sife

Frequency = 50Hz.



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