

NdFeB permanent magnets better resistant to corrosion and heat

The “S-series” of Neoflux ® (NdFeB) permanent magnet

The product range of NdFeB permanent magnets offered by Goudsmit Magnetic Supplies BV has been expanded recently, with a new in China developed Neoflux® (NdFeB) material. These so-called S-grade magnets are better resistant to corrosion and can be used in applications of up to 200°C.

As a result of special efforts in accordance with industrial development projects, nowadays, energy densities of 240-415 kJ/m³ (or 50 – 52 MGOe) for maximum operating temperatures of 60 °C up to more than 200°C can be set up in the alloy composition. At the same time, important results with regard to improving the corrosion resistance of NdFeB magnets have been achieved.

The corrosion behaviour of the new Neoflux S-grade magnets is close to being similar to the corrosion behaviour of St 37 Steel. The microstructure has been adjusted using suitable additive elements, leading to the replacement of the intergranular Nd-rich phase by other corrosion stable intergranular phases. The corrosion weight losses under the very severe conditions of a HAST test (Highly Accelerated Stress Test (or Pressure Cooker Test), 120-130°C, 100% humidity and 2.5-3 bar pressure) are insignificant after several days of testing. The typical weight losses of the Neoflux S-grades after 7 days of testing are approximately 1-2 mg/cm². Figure 1 compares Goudsmit's GSNS-grade magnets to traditional GSN-permanent magnets of Goudsmit and compared to customary Chinese GSN-35SH permanent magnets. The typical measured weight losses of the S-grade magnets are about 20-50 times lower than the weight losses of customary Chinese GSN-35SH permanent magnets.

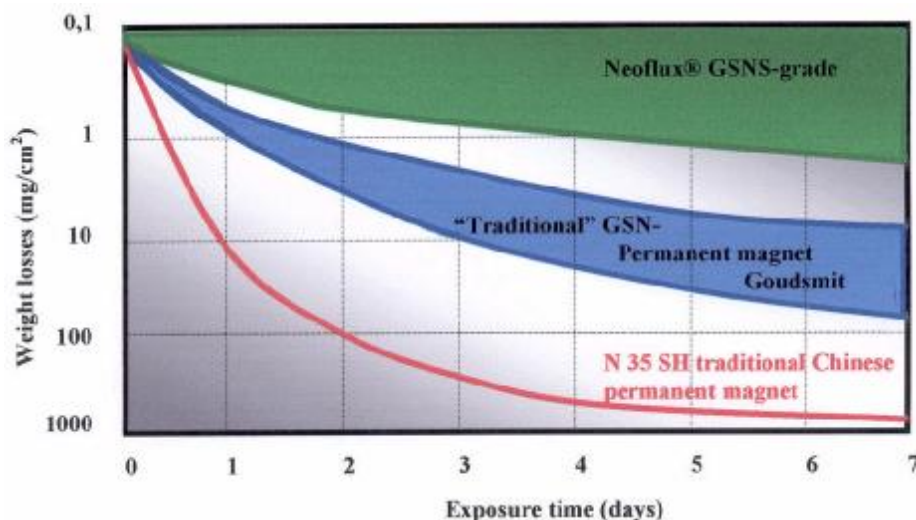


Figure 1: the typical weight losses under HAST conditions specified for maximum operating temperatures of 150°C.

Another very important advantage of the Neoflux S-grade magnets is the increase of the Curie-temperature of the $RE_2FE_{14}B$ compound (RE = Rare-Earths), causing improved thermal coefficients of the remanence and coercivity.

A magnetic grade is called “thermal stable” at a given temperature if the irreversible losses for a working point $B/\mu_0H \sim -1$ are lower than 3%. The new Neoflux S-grades S30EH, S32UH, S35SH and S38H can be used at high operating temperatures of 200°C, 180°C, 150°C and 120°C, respectively without considerable irreversible magnetic losses (see Table 1).

QUALITY	Br(T)	H _{cJ} (kA/m)	Br(T)	H _{cJ} (kA/m)	* Max. Operating temperatures At $B / \mu_0H \sim -1$
	20°C		150°C		
GSNS-30EH	1,10	> 2400	0,96	> 1150	200°C
GSNS-32UH	1,17	> 2000	1,00	> 800	180°C
GSNS-35SH	1,21	> 1600	1,05	> 600	150°C
GSNS-38H	1,26	> 1520	1,09	> 420	120°C

* The operating temperature depends partly on the dimensions of the magnet and the system design.

Table 1: typical magnetic specifications of NdFeB S-grade material at 20°C and 150°C

In summary:

Nowadays, the user has a range of stable NdFeB permanent magnets at his disposal with High-Tech-Quality and Chinese prices. The Neoflux S-grade magnets can be used under extreme circumstances. For example the GSNS-30EH magnets with an energy density of 240 kJ/m³ (~30 MGOe), Figure 2, can be used at temperatures of up to 200°C without appreciable irreversible losses. Moreover, the corrosion behaviour is comparable to that of St37 steel

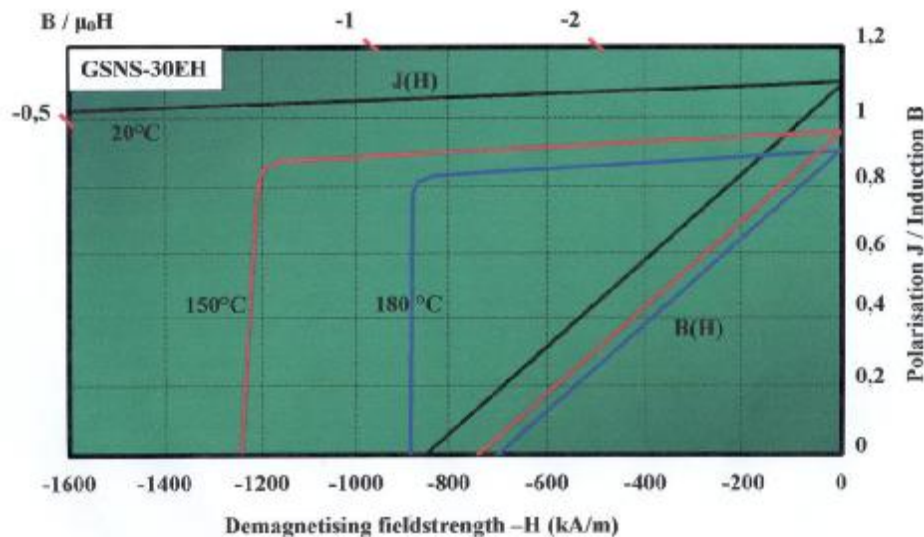


Figure 2: The typical demagnetisation curve of a permanent magnet in GSNS-30EH quality at high temperatures.