

(1) 超磁歪材料 ETREMA Terfenol-D の物理的・機械的性質

Table 1 . Nominal Properties of ETREMA Terfenol-D

Property	Units	Value
Density	[kg/m <sup>3</sup> ]	9.25 × 10 <sup>3</sup>
Young's modulus Y <sup>H</sup> (H=0)	[N/m <sup>2</sup> ]	2.5-3.5 × 10 <sup>10</sup>
Young's modulus Y <sup>B</sup> (B=0)	[N/m <sup>2</sup> ]	5.0-7.0 × 10 <sup>10</sup>
Sound speed c <sup>H</sup> (H=0)	[m/s]	1.72 × 10 <sup>3</sup>
Sound speed c <sup>B</sup> (B=0)	[m/s]	2.45 × 10 <sup>3</sup>
Permeability μ <sup>T</sup> (T=0)	[Tm/A]	9.2 × 4 × 10 <sup>-7</sup>
Permeability μ <sup>S</sup> (S=0)	[Tm/A]	4.5 × 4 × 10 <sup>-7</sup>
d constant d	[m/A]	1.50 × 10 <sup>-8</sup>
g constant g	[1/T]	1.28 × 10 <sup>-3</sup>
Coupling coefficient K	[-]	0.70-0.75
Resistivity ρ	[Ω·m]	60 × 10 <sup>-8</sup>
Impedance c <sup>H</sup> (H=0)	[rayls]	1.57 × 10 <sup>7</sup>
Impedance c <sup>B</sup> (B=0)	[rayls]	2.27 × 10 <sup>7</sup>
Frequency constant f <sup>H</sup> (H=0)	[Hz·m]	0.845 × 10 <sup>3</sup>
Frequency constant f <sup>B</sup> (B=0)	[Hz·m]	1.255 × 10 <sup>3</sup>

From Application Manual for the Design of T-D Magnetostrictive Transducers , by J.L.Butler

Table 2 . ETREMA Terfenol-D thermal, mechanical and magnetic properties

Property	Units	Value
Bulk Modulus	[N/m <sup>2</sup> ]	9 × 10 <sup>10</sup>
Tensile Strength	[MPa]	28
Compressive Strength	[MPa]	700
Curie Temperature	[ °C ]	380
Thermal Expansion Coefficient	[1/ °C ]	12 × 10 <sup>-6</sup>
Thermal Conductivity of Tb	[W/cm· °C ]	0.1
Thermal Conductivity of Fe	[W/cm· °C ]	1.0
Magnetization	[T]	1.0
Magnetostriction	[ppm]	1500-2000
Energy Density	[J/m <sup>3</sup> ]	14-15 × 10 <sup>3</sup>

From Application Manual for the Design of T-D Magnetostrictive Transducers , by J.L.Butler

**Table3 . DC Relative Permeability Values for ETREMA Terfenol-D**

<b>Prestress (MPa)</b>	<b>Approximate Relative Permeability</b>
0-1	30-70
7.0	9.0
14	8.0
27	7.0
42	5.3
55	4.0
65	3.5

From ETREMA Experimental Report, by Toby Hansen

**Table4 . AC Relative Permeability Values for ETREMA Terfenol-D**

<b>Operating Frequency Range</b>	<b>AC Relative Permeability</b>
10-1000 [Hz]	6.0
1-10 [kHz]	5.0
10-15 [kHz]	4.0
15-25 [kHz]	3.5
25-50 [kHz]	3.0

From ETREMA Experimental Report, by Toby Hansen