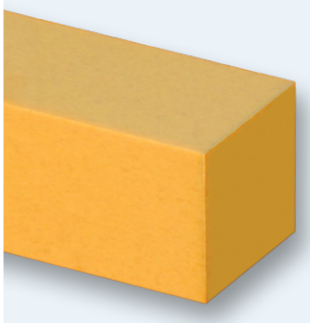
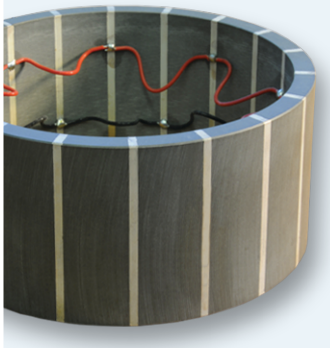
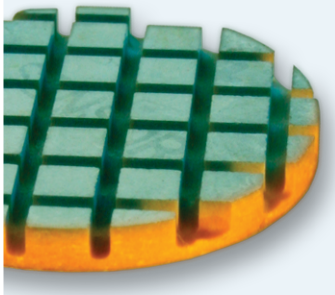
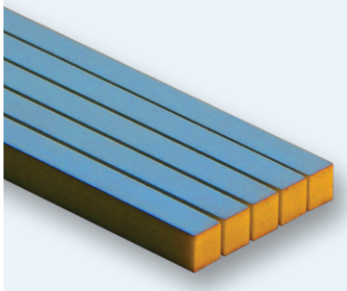
SENSOR TECHNOLOGY LTD









PIEZOELECTRIC CERAMICS

About Sensor Technology Ltd.

Founded in 1983, Sensor Technology Ltd. is a Canadian company. We export our products to customers around the globe according to the requirements of the Export and Import Permits Act of Canada (not ITAR, which is an American regulation).

PIEZOELECTRIC CERAMICS

Sensor Technology Ltd. is a vertically integrated manufacturer of piezoelectric ceramics. Our in-house powder production facility yields high quality Navy Types I, II, III, V and VI, as well as several custom formulations. Using an array of CNC machines, we can produce ceramics in any common shape — including tubes, slugs, plates, discs, washers, rings and hemispheres — or more complex custom geometries. Part sizes cover a wide range, from small 0.070" (1.78mm) diameter tubes to plates almost 7" (177.8mm) long.

With the ability to hold tight tolerances on dimensions, frequency, capacitance and form (parallelism, perpendicularity, flatness, concentricity, etc.), Sensor Technology Ltd. can provide consistent, reliable ceramics for the most demanding applications. We have experience with electrode segmentation and wrap-arounds, pre-stressing by fibre-wrapping and shear mode ceramics. Ceramics can also be provided as-fired.

Hard PZT

Sensor Technology Ltd. offers Navy Type I and III hard ceramics as BM400 and BM800 respectively. They are lead zirconate titanate compositions with low dielectric loss and excellent piezoelectric properties. These characteristics make them attractive for applications with highly-repetitive, quasi-static loads and large mechanical drive amplitudes.

BM400 (Navy Type I) offers a valuable balance between harder PZT materials (BM800, BM200) and soft PZT. BM400 can be used in transmit-only or transmit-receive services.

BM800 (Navy Type III) provides the lowest loss factor of Sensor Technology Ltd.'s hard PZT materials and is ideally suited for transmit applications with high power output and demanding duty cycles.

BM200 is the hardest piezoelectric ceramic produced by Sensor Technology Ltd. It is similar to BM800 (Navy Type III) but falls outside the Navy Type classifications. It finds use where an extremely hard piezoelectric ceramic is required.

Soft PZT

Sensor Technology Ltd. manufactures soft Navy Types II, V and VI as BM500, BM527 and BM532 respectively. They are lead zirconate titanates with high coupling coefficients and piezoelectric charge coefficients which are generally used in passive devices (e.g. hydrophones) and low-power resonators.

BM527 and BM532 are modified versions of BM500, offering significant increases in their dielectric and d constants. They are ideally suited for actuator applications requiring large mechanical displacements.

Lead Titanate

Sensor Technology Ltd.'s BM300 is a modified lead titanate composition with a very high anisotropy in its piezoelectric properties. It has negligible planar/radial mode. BM300 can be used to filter out signals arriving along a specific plane or for applications in which interference from radial/planar modes might otherwise be a problem.

Lead Metaniobate

BM900 series of ceramics (BM901, BM921 and BM941) are modified lead metaniobate compositions offering specialized performance characteristics.

BM901 has a low Q making it good for broadband applications, such as high fidelity ultrasonic imaging, as well as pulse/echo applications requiring a clean impulse response and fast ring down. It has the highest Curie temperature of any of Sensor Technology Ltd.'s materials, making it ideal for higher temperature applications.

BM941 offers the same low Q as BM901. It has a high frequency constant, making it a good choice for ultra-high frequency applications.

While BM921 provides similar high frequency performance to BM941, it is high Q material. It is well suited for specialized NDT applications.

Whether you are looking for a new piezoelectric ceramic supplier, a secondary source for your production requirements or an experienced team to provide a unique solution, Sensor Technology Ltd. can deliver.

Call or email to discuss your requirements.

Tel: +1-705-444-1440 / Fax: +1-705-444-6787 / email: techsupport@sensortech.ca

www.sensortech.ca

SENSOR TECHNOLOGY LTD

PIEZOELECTRIC MATERIAL SPECIFICATIONS[4]

	Symbols	Units	Soft PZT			Hard PZT			Lead Metaniobate			Lead Titanate
			BM500	BM527	BM532	BM400	BM800	BM200	BM901	BM921	BM941	BM300
Electrical[1]			Navy Type II	Navy Type V	Navy Type VI	Navy Type I	Navy Type III					
Relative Dielectric Constant	K_{33}^T	——	1750	2750	3250	1350	1000	1080	325	165	725	200
Dissipation Factor	$Tan\delta$	%	1.6	2.0	2.0	0.4	0.3	0.3	1.0	4.0	1.0	2.0
Piezoelectric												
Coupling Factor	k_p	——	0.62	0.62	0.65	0.60	0.50	0.60	0.07	0.10	0.20	0.05
	k_{31}	——	0.37	0.37	0.39	0.35	0.30	0.31	0.04	0.09	0.14	0.03
	k_{33}	——	0.72	0.72	0.75	0.70	0.64	0.64	0.40	0.40	0.45	0.51
Charge Constant	d_{31}	10^{-12} C/N	-175	-215	-270	-125	-85	-100	-10	-7	-40	-3
	d_{33}	10^{-12} C/N	365	500	590	300	225	250	90	65	180	70
Voltage Constant	g_{31}	10^{-3} V·m/N	-11.5	-9.5	-9.0	-10.5	-10.5	-10.0	-5.0	-5.0	-7.0	-2.0
	g_{33}	10^{-3} V·m/N	25	22	20	25	26	26	32	42	27	35
Mechanical Quality Factor	Q_M	——	80	70	70	500	1000	1000	15	600	15	800
Frequency Constants[2]	N_p	Hz·m	2050	2050	2000	2150	2350	2350	1650	3350	3250	2700
	N_1	Hz·m	1400	1400	1425	1650	1700	1770	1350	1675	1700	2100
	N_4	Hz·m	1800	1850	1850	1900	2000	1900	1540	2535	1725	2200
Mechanical												
Compliance	S_{11}^E	10^{-12} m²/N	15.5	14.5	14.0	12.5	11.0	10.8	27.5	9.5	7.4	7.2
	S_{33}^E	10^{-12} m²/N	19.0	19.5	20.0	15.0	13.5	15.4	21.0	14.7	21.0	9.0
Density	ρ	g/cm³	7.65	7.6	7.65	7.6	7.6	7.6	6.0	4.4	5.8	6.7
Curie Temperature	T_c	°C	360	225	210	350	325	330	490	290	280	225
Ageing Characteristics[3] (% change/time decade)												
Coupling Factor	k_p	——	-0.5	-1.0	-1.0	-2.5	-2.5	-2.5	—	-0.5	-0.5	-0.5
Relative Dielectric Constant	K_{33}^T	——	-1.0	-1.0	-1.0	-6.0	-6.0	-6.0	-1.5	-0.1	-1.0	-1.5
Frequency Constant	N_4	Hz·m	0.5	1.0	1.0	1.5	1.5	1.5	—	0.25	0.5	0.8

This table provides a quick comparison of the electrical and physical properties of Sensor Technology's piezoelectric materials.

Measurement of Material Constants

1) Low field parameters measured at 1kHz
2) N_p - Planar
   N_1 - Longtitudinal
   N_4 - Thickness
3) Reference point of time: 24 hours after polarization
4) All values are average nominal values. Actual production values vary.

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