Choosing of a Material

We manufacture an extensive selection of piezoelectric elements from our specially formulated, highest purity lead zirconate / lead titanate ceramics. Use a soft (sensor) ceramic - 5A18, 5B23, or 5H32 - for low-power resonance or non-resonance devices, when high coupling and/or high charge sensitivity are important. Choose an hard (high power) ceramic - 4A11, 4D13, or 8010 - when high power characteristics are required.

5A18 is an excellent material for flow or level sensors, such as ultrasonic or Doppler flow meters, gas flow sensors, and ultrasonic level sensors, for ultrasonic NDT / NDE applications, or for accurate inspections of automotive, structural, or aerospace products (construction materials, structural welds, transmission lines, steel storage tanks). 5A18 also is ideal for high performance transducers for medical imaging applications. A high dielectric constant, high coupling, high charge sensitivity, high density with a fine grain structure, a high Curie point, and a clean, noise-free frequency response are characteristic of 5A18.

5B23 and *5H32* are suited to applications similar to those in which 5A18 is used, when high permittivity and high piezoelectric charge coefficients are required. Although its properties are somewhat different from those of 5A18, 5H38 also is an excellent material for fluid flow sensors, level sensors, ultrasonic NDT / NDE applications, and medical imaging applications.

4A11 and *4D13* materials are widely used for generating ultrasonic or high-voltage energy in ultrasonic cleaners, sonar devices, etc. Important characteristics of 4D13 include a high piezoelectric charge constant (d33) relative to reference values for this formulation, greater power output per volume of material, a high mechanical quality factor that reduces mechanical loss and allows a lower operating temperature, and a low dissipation factor that ensures cooler, more economical operation.

High dielectric stability and low mechanical loss under demanding conditions make *8010* an excellent choice when the highest electrical drive is required.

Curie temperature (°C)	**Tc**	308	310	320	310	310	300	250	260	250	260
Density (g/cm^3)	**p**	7.7	7.7	7.7	7.6	7.6	7.6	7.7	7.7	7.7	7.7

Typical values of special piezoelectric ceramic materials

Material types		Impact	Impact	PZT-2	PZT-5X			
Properties	**Items**	1D07	1D10	2B05	5X45			
Coupling Coefficients	**Kp**	0.55	0.59	0.54	0.71			
	K_{33}				0.78			
	K_{31}				0.40			
Piezoelectric Charge Constants (PC/N)	**d_{33}**	280	360	230	740			
	d_{31}				-300			
Piezoelectric voltage constants ($X10^{-3}$Vm/N)	**g_{33}**	41	35	39	17.4			
	g_{31}				-7.20			
Dielectric constants	**$\varepsilon_{33}^T/\ \varepsilon_0$**	760	1100	560	4500			
Dissipation factor (%)	**tanδ**	0.50	0.45	0.40	2.00			
Frequency contents (Hz · M)	**Nt**				1890			
	Np				1984			
	N_{31}				1400			
Elastic constants ($X10^{10}N/m^2$)	**Y_{11}^E**				6.1			
	Y_{33}^E				5.1			
Mechanical Q	**Q_m**	1000	1200	1600	60			
Poison's ratio	**q^E**				0.35			
Curie temperature (^oC)	**Tc**				180			
Density (g/cm^3)	**p**	7.7	7.7	7.6	7.6			

These typical values are provided for design information only. Standard tolerances are approximately +/- 20% of these values. Material properties are measured according to standard IEEE and DOD definitions and measuring techniques. All data shown represent nominal characteristics (20 ^oC) 24 hours after polarization.