

Single Crystal Piezoelectrics

TRS' new single crystals possess exceptional properties and are poised to revolutionize piezoelectric materials applications. In addition to strain levels exceeding 1% (usable strain: 0.5% at 35 kV/cm), TRS crystals exhibit five times the strain energy density of conventional piezoceramics. Thus, unlike piezoceramic actuators that employ strain magnification schemes, single crystal actuators can deliver higher strain levels without sacrificing generative force. The high electromechanical coupling of TRS crystals (>90%) increases transducer bandwidth, resulting in greater sensitivity and acoustic power. In addition, low strain hysteresis results in improved high power efficiency, and lower acoustic impedance than piezoceramics allows for easier matching to air or water. High coupling also leads to dramatic improvement in passive vibration damping.

Typical Properties

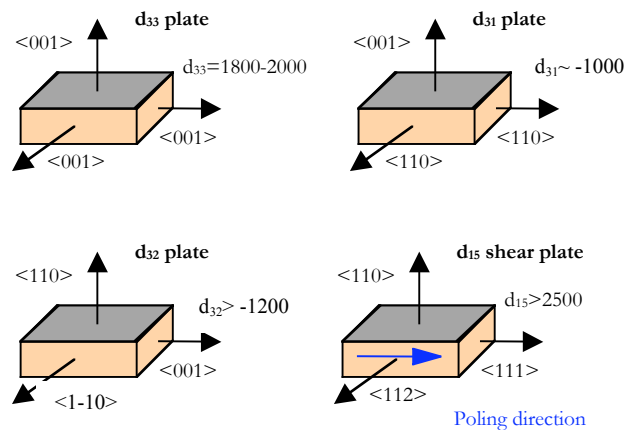
Property	PZN-4.5%PT	PMN-32%PT
Free K_3	5200	8000
Clamped K_3	1000	3000
Loss	<0.010	<0.01
Tc (°C)	155	166
Pr (pC/cm ²)	24	26
Ec (kV/cm)	2.5	3.2
d_{33} (pC/N)	1800-2000	1800-2000
d_{31} (pC/N)	-970	-1000
k_{33}	0.91	0.91
k_{31}	-0.50	-0.51
kp	N/A	N/A
kt	0.50	0.62
N_{33} (Hz-m)	528	599
N_{31} (Hz-m)	606	721
N_p (Hz-m)	N/A	N/A
N_t (Hz-m)	1778	2002
s_{33} (10 ⁻¹¹ m ² /N)	10.8	8.65
s_{11} (10 ⁻¹¹ m ² /N)	8.2	5.97
s_{12} (10 ⁻¹¹ m ² /N)	-2.85	-0.77
s_{13} (10 ⁻¹¹ m ² /N)	-5.10	-4.53
c_{33} (GPa)	105	129
c_{11} (GPa)	111	114
c_{12} (GPa)	102	100
c_{13} (GPa)	101	112

Crystals are available as plates, discs, rings or tubes. Standard metallization for plates, discs and rings is sputtered Cr/Au 500/2000Å. Plated Ni/Au is standard for tubes or rings with OD/ID metallization. Crystal PZN crystals are typically only available in sizes up to 10mm with some exceptions.

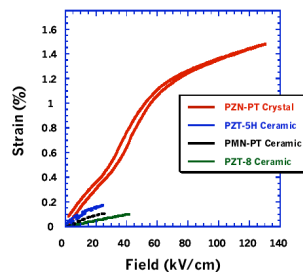
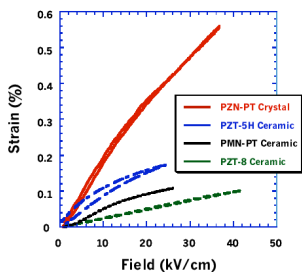
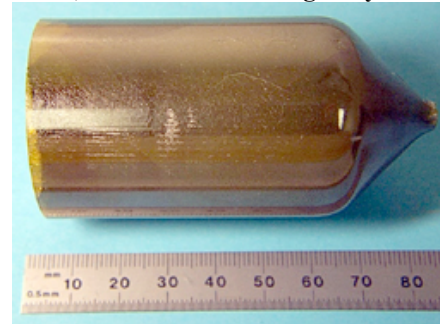
Typical size availability (mm)

Dimension	x	y	tolerance
x-y standard	1-20	1-20	0.1
x-y special	0.5-20	0.5-40	0.05
thickness standard	0.3-5.0		0.025
thickness special	0.1-0.3		0.01

Standard crystals are cut oriented <001> for d_{33} type applications. Additional crystal cuts are available with optimal properties for specific applications.



PMN-PT, 40mm diameter single crystal boule



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