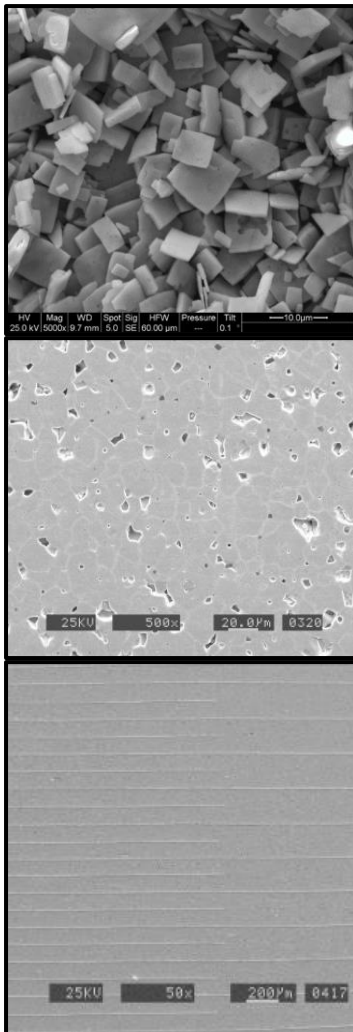


FEATURES

- Hybrid Solution
- Best of Soft PZT:
 - High d_{33}
 - High Coupling
- Best of Hard PZT:
 - Very Low Dielectric Loss
 - High Q_m



Micrographs of Seeds, Textured Microstructure, and Co-fired Stack

TENSOR PROPERTIES

Property		Units	QorTek TX101
Mechanical Properties			
Density	ρ	g/cm ³	7.6
Compliances	s_{11}^E	$\times 10^{-12}$ m ² /N	18.6
	s_{12}^E	$\times 10^{-12}$ m ² /N	0.6
	s_{13}^E	$\times 10^{-12}$ m ² /N	-17.8
	s_{33}^E	$\times 10^{-12}$ m ² /N	50
	s_{44}^E	$\times 10^{-12}$ m ² /N	
	s_{66}^E	$\times 10^{-12}$ m ² /N	36.1
Electrical Properties			
Dielectric Constant	K_{33}^T	-	1795
	K_{11}^T	-	1780
Dielectric Loss	$\tan\delta$	%	0.3
Piezoelectric Properties			
Coupling Factors	k_p	-	0.75
	k_{31}	-	0.56
	k_{33}	-	0.79
	k_t	-	0.58
	k_{15}	-	0.42
Charge or Strain Constants	d_{31}	pC/N	-290
	d_{33}	pC/N	710
	d_{15}	pC/N	
Voltage or Strain Constants	g_{33}	$\times 10^{-3}$ V m/N	44.1
	g_{31}	$\times 10^{-3}$ V m/N	-18.4
Frequency Constants	N_p	Hz-m	1675
	N_t	Hz-m	1700
Mechanical Quality Factor	Q_m	-	350
Time Stability			
Aging Rate - Dielectric	α	% per decade	-2.0
Aging Rate - d constants	α	% per decade	-1.0
Aging Rate - Coupling	α	% per decade	-0.6
Aging Rate - Frequency	α	% per decade	0.3

Typical Values measured at 20°C ±1°C are provided for design information only. Standard tolerances are approximately ±20% of these values. Material properties are measured according to IEEE standards and DOD definitions.

APPLICATIONS

- Hydrophones
- Underwater Projectors
- Energy Harvesting
- Multi-layer Co-fired Stacks
- Medical

COMPARISON CHART

Piezoceramic Type	<i>Hard</i>	<i>Hard</i>	Hybrid	<i>Soft</i>	<i>Single Crystal</i>
Material Name	<i>K1000</i>	<i>K1300</i>	QT-TX101	<i>3203</i>	<i>PIN Single Crystal</i>
Material Type	<i>PZT-8</i>	<i>PZT-4</i>	Textured	<i>PZT-5H</i>	<i>PIN24-PMN-PT</i>
Piezoelectric Coefficient, d_{33} (pC/N)	230	280	710	530	1285
Electromechanical Coupling Coefficient, k_p	0.51	0.55	0.75	0.69	0.88 - 0.90
Piezoelectric Coefficient, d_{31} (pC/N)	-95	-120	-290	-270	-646
Mechanical Quality Factor, Q_m	1000	500	350	50	150
Dielectric Constant, $K (\epsilon_{33})$	1000	1300	1795	3200	4753
Dissipation Factor, $\tan \delta$ (%)	0.4	0.5	0.3	2.0	<0.6