

PIEZOCERAMIC TUBES

For Ultra-precise Positioning Applications

- Ideal for STM/AFM
- Wide Variety of Piezo Materials
- Unlimited Electrode Configurations
- Custom Design Capability

EBL uses a proprietary machining process to fabricate tubes. Starting with fired ceramic, we machine, length grind, electrode, and polarize each tube to exacting tolerances. Although machining is more costly than extruding, pressing, or other bulk processing methods, only machined tubes like ours can meet the stringent requirements of wall thickness uniformity, straightness, and concentricity for all precision applications. Moreover, we will machine to virtually any geometry, which you require.

EBL's tube actuators are available with four different electrode types. Electroless nickel, our most popular electrode, gives a superior combination of low mass, thin, conductive layer, uniformity, durability, corrosion resistance, and adhesion. The addition of a thin layer of gold over electroless nickel improves solderability and conductivity, is nonmagnetic, and may be applied in fairly complex electrode patterns. Fired silver electrodes are available and compared with electroless nickel, however, fired silver has a number of significant drawbacks: greater electrode thickness, greater thickness variability, and the mechanical distortion the tubes can undergo, when exposed to the high temperatures required for the silver firing process.



PIEZOCERAMIC TUBE CHARACTERISTICS

MATERIAL PROPERTIES	EBL #1	EBL #2	EBL #3	EBL #4	EBL #9	EBL #23	EBL #25	
d ₃₁ Å/V@293°K	-1.27	-1.73	-2.62	95	-1.35	-3.20	-1.90	
d ₃₃ Å/V@293°K	2.95	3.80	5.83	2.20	3.15	6.50	3.90	
d ₃₁ Å/V@4.2°K	-	-0.31	-0.33	-	-	-	-	
d ₃₃ Å/V@4.2°K	-	0.69	0.74	-	-	-	-	
Dielectric constant K_3^{T}	1300	1725	3450	1050	1450	3800	1800	
AC depoling field kV/cm rms	10	7	4	15	10	5	7	
Young's modulus 10 ¹⁰ N/m ²	8.1	6.3	6.3	8.5	7.5	7.5	7.9	
Curie Temperature °C	320	350	190	300	320	250	350	
Thermal conductivity W/m°C	2.1	1.5	1.5	2.1	2.1	2.0	2.0	
Thermal expansion coefficient ppm/°C	-	-	4.7	3.0	-	3.5	3.0	
Density g/cm ³	7.5	7.5	7.45	7.5	7.6	7.8	7.7	
Mechanical Q	400	100	65	960	600	30	80	
Poisson's ratio	0.31	0.31	0.31	0.31	0.31	0.31	0.34	
Industry type	PZT-4	PZT-5A	PZT-5H	PZT-8	PZT-4D	-	-	

The above values are nominal. Thermal data are compiled from a variety of sources and are provided for convenience only. Hysteresis is a complex property for which no hard data exists. Generally however, hysteresis decreases with increasing mechanical Q.

Specification subject to change without notice.

Polarization:

OD positive; OD negative on special request

D	esi	ign	Fo	rm	ula	ae
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t = wall thickness

Eo=8.85 x 1012 Farad/meter



EBL Products, Inc. 22 Prestige Park Circle East Hartford, CT 06108

Ph. 860-290-3737 Fax. 860-291-2533 E-Mail. sales@eblproducts.com