

The Main characteristics of Piezoelectric Ceramic

No.	Parameters	Symbols	Material			
			P -41 (PZT4)	P-51 (PZT5)	P -81 (PZT8)	P -48 (PZT48)
P	Coupling Coefficients	k_p	0.56	0.66	0.54	0.59
		k_{31}	0.33	0.39	0.31	0.34
		k_{33}	0.66	0.74	0.63	0.7
		k_t	0.48	0.50	0.47	0.49
2	Dielectric constant(1kHz)	ϵ_{r3}^T	1050	2400	1050	1350
		ϵ_{r1}^T	1450	2700	1400	1600
3	Dielectric Loss Factor	$\text{tg } \delta$	0.004	0.017	0.003	0.004
4	Elastic Constants ($\times 10^{-12} \text{m}^2/\text{N}$)	S_{11}^E	12.0	15.0	11.0	12.5
		S_{33}^D	8.5	9.0	8.5	8.5
5	Piezoelectric Coefficients ($10^{-12} \text{C}/\text{N}$)	d_{31}	-110	-210	-100	-140
		d_{33}	270	550	230	320
6	Mechanical Quality Factor	Q_M	600	70	1000	800
7	Frequency Constants ($\text{Hz} \cdot \text{m}$)	N_d	2250	1980	2300	2230
		N_1	1650	1450	1700	1600
		N_3	1950	1900	1960	2000
		N_t	2270	2250	2280	2300
8	Sound velocity (m/s)	V_d	3460	3000	3500	3400
		V_1	3300	2900	3400	3200
		V_3	3900	3800	3920	4000
		V_t	4540	4500	4560	4600
9	Density($10^3 \text{kg}/\text{m}^3$)	ρ	7.60	7.65	7.65	7.70
10	Curie Point($^{\circ}\text{C}$)	T_c	310	280	300	300
11	Ten times the rate of time (%)	A_{nd}	1.3	0.35	1.3	1.2
		A_{kp}	-2.5	-0.40	-2.0	-1.6
		$A \epsilon$	-4.5	-1.5	-4.0	-3.5
12	Temperature changes($\%$)- $10^{\circ}\text{C} \sim 50^{\circ}\text{C}$ to 25°C	$\Delta N_d/N$	1.0	1.5	1.5	1.0
		$\Delta \epsilon / \epsilon$	9.5	20	9.0	9.5
13	Dielectric Properties in High Electric	$\text{tg } \delta$	0.040		0.010	0.025
		$\Delta \epsilon / \epsilon$	0.18		0.06	0.20

Note: These data are typical values of the main parameters measured at 25°C , 10 days after polarization.