

The Main characteristics of Piezoelectric Ceramic Materials(WXHF)

No.	Parameters	Symbols	Materials					
			P-41	P-42	P-43	P-44	P-45	P-48
1	Coupling Coefficients	k_p	0.56	0.58	0.62	0.61	0.61	0.59
		k_{31}	0.33	0.34	0.36	0.36	0.35	0.34
		k_{33}	0.66	0.67	0.74	0.73	0.69	0.7
		kt	0.48	0.48	0.48	0.49	0.48	0.49
2	Dielectric constant(1kHz)	ϵ_{r3}^T	1050	1300	1650	1600	1450	1350
		ϵ_{r1}^T	1450	1700	1750	1800	1700	1600
3	Dielectric Loss Factor	$tg \delta$	0.004	0.005	0.005	0.005	0.004	0.004
4	Elastic Constants ($\times 10^{-12} m^2/N$)	S_{11}^E	12.0	11.5	12.5	13.0	12.8	12.5
		S_{33}^D	8.5	8.0	8.5	8.5	8.8	8.5
5	Piezoelectric Coefficients ($\times 10^{-12} C/N$)	d_{31}	-110	-130	-150	-145	-140	-140
		d_{33}	270	290	360	350	330	320
6	Mechanical Quality Factor	Q_M	600	800	1300	500	1400	800
7	Frequency Constants (Hz·m)	N_d	2250	2200	2170	2190	2220	2230
		N_1	1650	1700	1570	1600	1640	1600
		N_3	1950	2050	2000	2000	2060	2000
		N_t	2270	2300	2300	2300	2300	2300
8	Sound velocity (m/s)	V_d	3460	3500	3450	3400	3400	3400
		V_1	3300	3400	3200	3200	3400	3200
		V_3	3900	4100	4000	4000	4100	4000
		V_t	4540	4600	4600	4550	4600	4600
9	Density($10^3 kg/m^3$)	ρ	7.60	7.65	7.70	7.65	7.70	7.70
10	Curie Point(°C)	T_c	310	300	290	300	320	300
11	Ten times the rate of time (%)	A_{Nd}	1.3	1.3	1.2	1.2	1.1	1.2
		A_{kp}	-2.5	-2.0	-1.6	-1.8	-1.5	-1.6
		$A \epsilon$	-4.5	-4.5	-4.0	-4.5	-4.5	-3.5
12	Temperature changes(%)-10°C~50°C to 25°C	$\Delta N_d/N$	1.0	1.5	1.0	1.0	1.0	1.0
		$\Delta \epsilon / \epsilon$	9.5	9.5	10.0	9.0	8.0	9.5
13	Dielectric Properties in High Electric	$tg \delta$	0.040	0.040	0.035	0.043	0.035	0.025
		$\Delta \epsilon / \epsilon$	0.18	0.20	0.19	0.21	0.19	0.20

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

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No.	Parameters	Symbols	Materials					
			P-31	P-32	P-33	P-51	P-52	P-53
1	Coupling Coefficients	k_p	0.55	0.63	0.66	0.66	0.68	0.66
		k_{31}	0.33	0.35	0.37	0.39	0.40	0.36
		k_{33}	0.68	0.70	0.72	0.74	0.76	0.74
		k_t	0.47	0.49	0.50	0.50	0.50	0.55
2	Dielectric constant(1kHz)	ϵ_{r3}^T	1700	1750	1850	2400	3500	4800
		ϵ_{r1}^T	2000	2100	2100	2700	4100	5200
3	Dielectric Loss Factor	$tg \delta$	0.013	0.017	0.017	0.017	0.014	0.020
4	Elastic Constants ($\times 10^{-12} m^2/N$)	S_{11}^E	15.0	15.5	15.8	15.0	16.5	15.1
		S_{33}^D	9.0	9.0	9.3	9.0	8.2	8.0
5	Piezoelectric Coefficients ($10^{-12} C/N$)	d_{31}	-150	-180	-190	-210	-295	-330
		d_{33}	380	420	450	550	660	740
6	Piezoelectric voltage constant ($\times 10^{-3} V \cdot m/N$)	g_{31}	-10	-13	-12.8	-10.8	-9.5	-7.5
		g_{33}	24	27	27	24	19.8	17.8
7	Mechanical Quality Factor	Q_M	100	90	80	70	80	50
8	Frequency Constants (Hz·m)	N_d	2060	2000	1990	1980	1920	1940
		N_1	1550	1470	1470	1450	1400	1400
		N_3	1900	1880	1880	1900	1900	1870
		N_t	2250	2250	2250	2250	2300	2220
9	Sound velocity (m/s)	V_d	3100	3000	3000	3000	2920	2960
		V_1	2900	2940	2940	2900	2900	2900
		V_3	3800	3760	3760	3800	3800	3840
		V_t	4500	4500	4500	4500	4600	4790
10	Density($10^3 kg/m^3$)	ρ	7.70	7.70	7.70	7.65	7.60	7.60
11	Curie Point($^{\circ}C$)	T_c	350	370	345	280	220	185
12	Ten times the rate of time (%)	A_{Nd}	0.35	0.06	0.07	0.35	0.35	0.10
		A_{kp}	-0.40	-0.16	-0.20	-0.40	-0.25	-0.37
		$A \epsilon$	-1.5	-0.3	-0.3	-1.5	-2.0	-1.4
13	Temperature changes($\% -10^{\circ}C \sim 50^{\circ}C$ to $25^{\circ}C$)	$\Delta N_d/N$	1.0	1.0	1.2	1.5	2.0	2.0
		$\Delta \epsilon / \epsilon$	13	13	16	20	40	50

Note: These data are typical values of the main parameters measured at $25^{\circ}C$, 10 days after polarization.

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No.	Parameters	Symbols	Materials				
			P-81	P-82			
1	Coupling Coefficients	k_p	0.54	0.58			
		k_{31}	0.31	0.32			
		k_{33}	0.63	0.65			
		k_t	0.47	0.48			
2	Dielectric constant(1kHz)	ϵ_{r3}^T	1050	1200			
		ϵ_{r1}^T	1400	1600			
3	Dielectric Loss Factor	$tg \delta$	0.003	0.003			
4	Elastic Constants ($\times 10^{-12} m^2/N$)	S_{11}^E	11.0	11.5			
		S_{33}^D	8.5	8.8			
5	Piezoelectric Coefficients ($10^{-12} C/N$)	d_{31}	-100	-115			
		d_{33}	230	280			
6	Mechanical Quality Factor	Q_M	1100	900			
7	Frequency Constants (Hz·m)	N_d	2300	2300			
		N_1	1700	1700			
		N_3	1960	1930			
		N_t	2280	2250			
8	Sound velocity (m/s)	V_d	3500	3500			
		V_1	3400	3400			
		V_3	3920	3860			
		V_t	4560	4500			
9	Density($10^3 kg/m^3$)	ρ	7.65	7.70			
10	Curie Point(°C)	T_c	300	300			
11	Ten times the rate of time (%)	A_{Nd}	1.3	1.3			
		A_{kp}	-2.0	-2.0			
		A_ϵ	-4.0	-4.0			
12	Temperature changes(%)-10°C~50°C to 25°C	$\Delta N_d/N$	1.5	1.5			
		$\Delta \epsilon / \epsilon$	9.0	9.0			
13	Dielectric Properties in High Electric	$tg \delta$	0.010	0.012			
		$\Delta \epsilon / \epsilon$	0.06	0.10			

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