

C E R A M T E C

# Piezoceramic Hard Materials

CA220108/EN/2205/IM



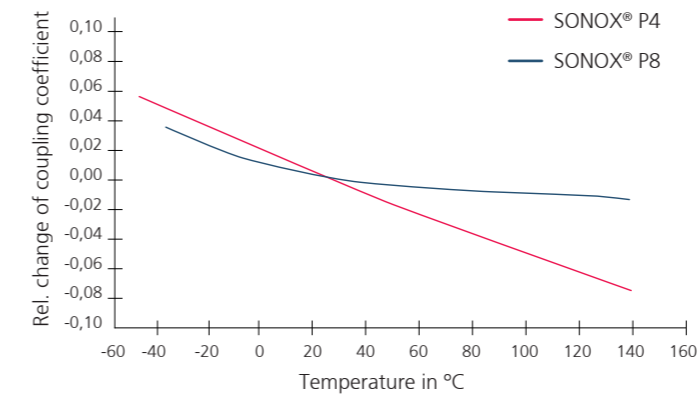
# Material characteristics

# Thermal dependency of piezo electric characteristics

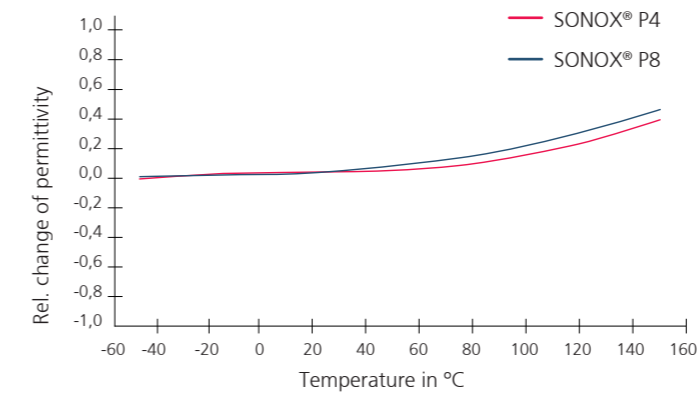
Material		Sonox® P4	PZT401	PZT406	Sonox® P8	PZT807	
Navy Type		I	I	I	III	III	
<b>Dielectric properties</b>							
Relative permittivity $\epsilon_r$	$\epsilon_{33}^T/\epsilon_0$	1300	1395	1325	1000	1105	
	$\epsilon_{33}^S/\epsilon_0$	660	735	660	540	625	
	$\epsilon_{11}^T/\epsilon_0$	1535	1330	1295	1250	1190	
	$\epsilon_{11}^S/\epsilon_0$	885	680	980	800	830	
Dielectric dissip. factor $\tan \delta$	$10^{-3}$	3,0	2,0	1,8	2,0	1,6	
Curie temperature $T_c$	C°	325	330	325	305	300	
<b>Electromechanical properties</b>							
Frequency constant	$N_p$	2210	2190	2190	2280	2320	
	$N_t$	2000	2080	2015	2020	2030	
	$N_1$	1480	1635	1530	1600	1720	
	$N_3$	1340	1550	1500	1490	1660	
Coupling coefficient	$k_p$	0,57	0,58	0,61	0,55	0,55	
	$k_{31}$	0,31	0,35	0,34	0,30	0,29	
	$k_{33}$	0,68	0,67	0,70	0,68	0,69	
	$k_t$	0,50	0,50	0,47	0,48	0,47	
	$k_{15}$	0,65	0,70	0,60	0,60	0,58	
Charge constant	$d_{33}$	310	315	315	240	260	
	$d_{31}$	-130	-130	-130	-95	-90	
	$d_{15}$	455	510	550	380	295	
Voltage constant $g_{33}$	$10^{-3}$ Vm/N	26,9	25,5	26,9	27,1	26,6	
<b>Mechanical properties</b>							
Elastic compliance	$S_{11}^E$	14,9	12,7	13,0	11,4	10,9	
	$S_{33}^E$	18,1	15,6	15,0	13,7	15,7	
Elastic stiffness	$C_{33}^D$	15,9	15,0	15,2	16,2	16,3	
	$C_{55}^D$	4,8	4,9	4,0	4,5	4,7	
Density $\rho$	$10^3$ kg/m <sup>3</sup>	7,65	7,60	7,80	7,70	7,60	
Mechan. quality factor $Q_m$		500	600	750	1000	1200	
<b>Stability</b>							
Aging rate	Capacitance	%/Decade	-4,5	-4,6	-6,0	-3,0	-3,5
	Frequency		1,0	1,0	0,5	0,8	0,8
	Coupling coefficient		-1,6	-1,5	-2,5	-2,0	-1,5

The materials data shown were evaluated on specific sample components and shall only be used to give an indication for design purposes. These values were determined based on national and international standards, if those standards were not available, then the values were determined on the basis of CeramTec internal standards. The displayed values are material properties and do not guarantee any properties of piezoceramic parts / products. CeramTec and its affiliates do not assume any responsibility for the correctness of such information nor for any damages subject to its use. Please note that material specifications and information detailed in this media are subject to changes.

Relative temperature dependence of coupling coefficient



Relative temperature dependence of permittivity



Relative temperature dependence of serial resonant frequency

