

TABLE I. Measured and derived material constants of PIN-PMN-28%PT and PIN-PMN-32%PT multidomain single crystals poled along [011]<sub>c</sub>. [Directly measured constants are denoted by star (\*).]

		Elastic stiffness constants: $c_{ij}^E$ and $c_{ij}^D$ ( $10^{10}$ N/m <sup>2</sup> )											
		$c_{11}^{E*}$	$c_{12}^E$	$c_{13}^E$	$c_{22}^{E*}$	$c_{23}^E$	$c_{33}^E$	$c_{44}^{E*}$	$c_{55}^{E*}$	$c_{66}^{E*}$			
28%PT		19.96	12.51	7.19	13.54	11.89	15.36	6.49	0.76	5.33			
32%PT		21.45	15.01	8.01	17.37	14.10	15.26	6.37	0.48	4.56			
		$c_{11}^D$	$c_{12}^D$	$c_{13}^D$	$c_{22}^D$	$c_{23}^D$	$c_{33}^{D*}$	$c_{44}^{D*}$	$c_{55}^{D*}$	$c_{66}^D$			
28%PT		20.19	12.10	8.26	14.25	10.02	20.21	7.15	4.56	5.33			
32%PT		21.50	14.86	8.46	17.94	12.39	20.35	7.30	4.59	4.56			
		Elastic compliance constants: $s_{ij}^E$ and $s_{ij}^D$ ( $10^{-12}$ m <sup>2</sup> /N)											
		$s_{11}^{E*}$	$s_{12}^E$	$s_{13}^E$	$s_{22}^{E*}$	$s_{23}^E$	$s_{33}^{E*}$	$s_{44}^E$	$s_{55}^E$	$s_{66}^E$			
28%PT		18.27	-29.36	14.05	69.97	-40.37	31.23	15.41	131.58	18.76			
32%PT		25.53	-45.13	27.87	101.45	-70.31	56.84	15.70	208.33	21.93			
		$s_{11}^D$	$s_{12}^D$	$s_{13}^D$	$s_{22}^D$	$s_{23}^D$	$s_{33}^{D*}$	$s_{44}^D$	$s_{55}^D$	$s_{66}^D$			
28%PT		10.07	-8.75	0.11	18.18	-5.33	7.59	13.99	21.93	18.76			
32%PT		11.21	-10.84	1.63	19.37	-7.50	8.79	13.70	21.79	21.93			
		Piezoelectric coefficients: $e_{\lambda}(C/m^2)$ , $d_{\lambda}(10^{-12} C/N)$ , $g_{\lambda}(10^{-3} Vm/N)$ , and $h_{\lambda}(10^8 V/m)$											
		$e_{15}$	$e_{24}$	$e_{31}$	$e_{32}$	$e_{33}$	$d_{15}$	$d_{24}$	$d_{31}^*$	$d_{32}^*$	$d_{33}^*$		
28%PT		16.74	7.39	3.43	-6.00	15.74	2203	114	460	-1156	782		
32%PT		16.10	10.32	1.44	-5.50	16.47	3354	162	744	-1781	1363		
		$g_{15}$	$g_{24}$	$g_{31}$	$g_{32}$	$g_{33}$	$h_{15}$	$h_{24}$	$h_{31}$	$h_{32}$	$h_{33}$		
28%PT		49.79	12.51	17.80	-44.73	30.26	22.71	8.94	6.79	-11.89	31.20		
32%PT		55.63	12.34	19.28	-46.15	35.32	25.51	9.01	2.72	-10.41	31.17		
		Dielectric constants: $\epsilon_{ij}(\epsilon_0)$ and $\beta(10^{-4}/\epsilon_0)$											
		$\epsilon_{11}^{S*}$	$\epsilon_{22}^{S*}$	$\epsilon_{33}^{S*}$	$\epsilon_{11}^{T*}$	$\epsilon_{22}^{T*}$	$\epsilon_{33}^{T*}$	$\beta_{11}^S$	$\beta_{22}^S$	$\beta_{33}^S$	$\beta_{11}^T$	$\beta_{22}^T$	$\beta_{33}^T$
28%PT		833	935	570	5000	1030	2920	12.01	10.70	17.54	2.00	9.71	3.43
32%PT		713	1294	597	6814	1483	4361	14.03	7.73	16.75	1.47	6.74	2.29

Electromechanical coupling factors  $k_{ij}$  and density

\* TRS X4B crystals tested at Penn State

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Elastic, dielectric, and piezoelectric constants of Pb(In<sub>1/2</sub>Nb<sub>1/2</sub>)O<sub>3</sub>-Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub> single crystal poled along <011>

Enwei Sun, Shujun Zhang, Jun Luo, Thomas R. Shrout, and Wenwu Cao