

Supplementary Material

Fabrication and characterization of lead-free BNT-6BT ultrasonic transducers designed by intelligent optimization algorithm

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Table S1. Orthogonal design of ultrasonic transducer

Case	Thickness of PZT (μm)	Diameter of PZT (mm)	Thickness of Ag-epoxy (μm)	Center frequency (MHz)	-6dB bandwidth (%)	Electrical impedance (Ω)
1	750	11	175	3.067	58.63	62.747
2	760	15	155	3.152	55.52	34.243
3	785	19	195	2.841	63.23	23.708
4	765	13	155	3.146	55.68	46.206
5	755	13	165	3.107	57.98	45.796
6	775	12	175	2.998	58.66	56.081
7	770	17	155	3.119	54.78	34.135
8	755	14	185	2.982	62.02	40.39
9	780	15	185	2.917	61.11	36.839
10	755	17	190	2.943	63.89	27.729
11	765	17	195	2.892	64.49	28.353
12	760	11	180	3.012	58.76	64.116
13	765	16	160	3.103	56.19	30.824
14	765	12	170	3.053	58.6	54.199
15	745	13	170	3.101	59.56	44.043
16	745	17	165	3.121	58.15	25.708
17	775	18	170	3.01	57.74	24.743
18	775	11	190	2.92	59.28	69.399
19	745	15	190	2.975	64.06	33.107
20	760	12	165	3.098	57.83	53.644
21	785	15	160	3.054	55.58	37.15
22	775	14	195	2.88	62.58	41.899
23	745	16	175	3.059	60.66	29.233
24	750	13	190	2.972	62.36	46.674
25	785	13	185	2.913	59.97	49.369
26	770	16	180	2.967	60.46	32.179

27	780	18	190	2.881	62.29	25.408
28	770	14	165	3.064	57.25	41.38
29	750	14	180	3.023	61.51	40.792
30	785	14	175	2.966	58.66	43.204
31	745	19	180	3.022	61.88	21.535
32	760	17	175	3.019	59.77	27.745
33	750	15	165	3.113	58.06	33.277
34	785	16	190	2.875	62.01	32.259
35	775	16	165	3.045	56.83	31.158
36	775	17	185	2.923	61.37	27.692
37	780	19	175	2.965	58.59	22.64
38	760	16	185	2.962	62.27	31.465
39	745	18	195	2.938	65.87	23.776
40	750	16	195	2.932	65.25	31.122
41	760	13	195	2.921	62.63	48.07
42	765	18	180	2.974	60.69	25.127
43	750	19	185	2.98	62.88	20.709
44	780	13	180	2.953	59.63	49.174
45	750	17	170	3.075	59.1	26.223
46	755	11	195	2.944	60.96	66.361
47	765	19	165	3.065	56.97	22.355
48	770	18	185	2.933	61.64	24.87
49	765	14	190	2.93	62.3	40.909
50	745	12	185	3.017	60.97	53.465
51	770	15	195	2.887	63.52	36.529
52	760	14	170	3.058	58.76	39.881
53	755	18	175	3.029	60.01	24.088
54	785	17	180	2.928	59.62	29.404
55	780	12	195	2.878	60.65	58.76
56	765	15	175	3.012	59.59	35.873
57	765	11	185	2.971	59.11	67.704
58	755	12	180	3.019	59.82	54.247
59	760	19	190	2.927	63.54	21.56
60	770	19	170	3.021	57.91	22.251
61	755	15	170	3.068	58.95	35.249
62	770	13	175	3.006	59.42	46.805
63	770	12	190	2.927	60.44	55.722
64	775	15	180	2.957	60.22	36.789