



Onda Corporation  
 592 Weddell Drive, Suite 7, Sunnyvale, CA 94089  
 PH: (408) 745 - 0383 FAX: (408) 745 - 0956

# Acoustic Properties of Solids

Ref	Material	Vendor	VL mm/: s	VS mm/: s	D g/cm3	ZL MRayl	F	Loss dB/cm
AS	Alumina	Mason	10.52		3.86	40.6		
CRC	Aluminum - rolled		6.42	3.04	2.70	17.33	0.355	
RLB	Aluminum - 6262-T9		6.38		2.73	17.41		
	AMD Res-in-all - 502/118, 5:1	AMD	2.67		1.35	3.61		
	AMD Res-in-all - 502/118, 9:1	AMD	2.73		1.35	3.68		
JA	Araldite - 502/956	Ciba	2.62		1.16	3.04		
JA	Araldite - 502/956, 10phe C5W	Ciba,Li	2.60		1.23	3.19		
JA	Araldite - 502/956, 20phe C5W	Ciba,Li	2.54		1.39	3.52		
JA	Araldite - 502/956, 30phe C5W	Ciba,Li	2.41		1.50	3.62		
JA	Araldite - 502/956, 40phe C5W	Ciba,Li	2.31		1.67	3.86		
JA	Araldite - 502/956, 50phe C5W	Ciba,Li	2.13		1.95	4.14		
JA	Araldite - 502/956, 60phe C5W	Ciba,Li	2.10		2.24	4.70		
JA	Araldite - 502/956, 70phe C5W	Ciba,Li	1.88		3.17	5.95		
JA	Araldite - 502/956, 80phe C5W	Ciba,Li	1.72		4.71	8.11		
JA	Araldite - 502/956, 50phe 325mesh W	Ciba,Li	2.16		2.86	6.17		
JA	Araldite - 502/956, 60phe 325mesh W	Ciba,Li	1.91		2.78	5.33		
JA	Araldite - 502/956, 70phe 325mesh W	Ciba,Li	1.82		3.21	5.84		
JA	Araldite - 502/956, 80phe 325mesh W	Ciba,Li	1.64		4.55	7.45		
JA	Araldite - 502/956, 90phe 325mesh W	Ciba,Li	1.52		8.40	12.81		
AS	Arsenic tri sulphide As <sub>2</sub> S <sub>3</sub>	Ch	2.58	1.40	3.20	8.25	0.29	
	Bacon P38	Bacon	4.00	2.17	1.90	7.60	0.29	13.5 @ 5
M	Bearing babbit		2.30		10.1	23.2		
CRC	Beryllium		12.89	8.88	1.87	24.10	0.046	
	Bismuth		2.2	1.1	9.8	21.5	0.33	
	Boron carbide		11.0		2.4	26.4		
PK	Boron nitride		5.03	3.86	1.965	9.88		
	Brass - yellow, 70% Cu, 30% Zn		4.70	2.10	8.64	40.6	0.38	
	Brick		4.3		1.7	7.4		
	Cadmium		2.8	1.5	8.6	24.0	0.30	
AS	Carbon -pyrolytic, soft, variable properties		3.31		2.21	7.31		
AS	Carbon - vitreous, very hard material	Fl	4.26	2.68	1.47	6.26	0.17	



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AS	Carbon - vitreous, Sigradur K	Si	4.63		1.59	7.38		
	Columbium (same as Niobium) m.p. 2468°C	C	4.92	2.10	8.57	42.4	0.39	
KF	Concrete		3.1		2.6	8.0		
CRC	Copper, rolled		5.01	2.27	8.93	44.6	0.37	
AS	DER317 - 9phr DEH20, 110phr W, r3	C,E	2.18	0.96	2.04	4.45	0.38	6.6 @ 2
AS	DER317 - 9phr DEH20, 115phr W, r3	C,E	1.93		2.37	4.58		
AS	DER317 - 9phr DEH20, 910phr T1167, r3	C,E	1.50		7.27	10.91		13.2 @ 2
AS	DER317 - 10.5phr DEH20 rt, outgass	E	2.75		1.18	3.25		
AS	DER317 - 10.5phr DEH20, 110phr W, r3	E,C	2.07		2.23	4.61		8.3 @ 2
AS	DER317 - 13.5phr mpda, 50phr W, r1	C,D,E	2.40		1.60	3.84		
AS	DER317 - 13.5phr mpda, 100phr W, r1	C,D,E	2.19		2.03	4.44		
AS	DER317 - 13.5phr mpda, 250phr W, r1	C,D,E	1.86	0.93	3.4	6.4	0.33	
AS	DER332 - 10phr DEH20, rt cure 48 hours	E	2.60		1.20	3.11		
AS	DER332 - 10phr DEH20, 120phr alumina, r2	B,E	3.18	1.62	1.76	5.58	0.32	
AS	DER332 - 10.5phr DEH20, 10phr alumina, r2	B,E	2.61		1.26	3.29		
AS	DER332 - 10.5phr DEH20, 14phr alumina, r2	B,E	2.65		1.29	3.41		
AS	DER332 - 10.5phr DEH20, 30phr alumina, r2	B,E	2.75		1.37	3.78		
	DER332 - 11phr DEH20, 14phr alumina, r10	B,E	2.71		1.29	3.49		5.4 @ 2
AS	DER332 - 11phr DEH20, 150phr alumina, r2	B,E	3.25		1.83	5.95		
AS	DER332 - 11phr DEH20,150phr alumina,50phr LP3,rt	B,E,T	2.35		1.72	4.05		23.7 @ 2
AS	DER332 - 14phr mpda, 30phr LP3, 70°C cure	D,E,T	2.59		1.25	3.24		8.3 @ 2
AS	DER332 - 15phr mpda, 60°C cure	D,E	2.68	1.15	1.21	3.25	0.37	6.7 @ 2
AS	DER332, 15phr mpda, 25phr LP3, 76°C cure	D,E,T	2.55	1.18	1.24	3.16	0.36	7.4 @ 1.3
AS	DER332 - 15phr mpda, 30phr LP3, 80°C cure	D,E,T	2.66		1.24	3.30		8.8 @ 2
AS	DER332 - 15phr mpda, 50phr alumina, 60°C cure	B,D,E	2.8	1.43	1.49	4.18	0.32	
AS	DER332 - 15phr mpda, 60phr alumina, 80°C cure	B,D,E	2.78	1.45	1.54	4.27	0.31	
AS	DER332 - 15phr mpda, SiC, r5	C,D,E	3.90		2.24	8.74		
AS	DER332 - 15phr mpda, SiC, 25phr LP3, r5	C,D,E,T	3.75		2.15	8.06		
AS	DER332 - 15phr mpda, 6 micron W, r5	C,D,E	1.75		6.45	11.3		



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AS	DER332 - 50phr V140, rt cure	E,GM	2.34	0.97	1.13	2.64	0.40	
AS	DER332 - 64phr V140, rt cure	E,GM	2.36		1.13	2.65		
AS	DER332 - 75phr V140, rt cure	E,GM	2.35		1.12	2.62		
AS	DER332 - 100phr V140, rt cure	E,GM	2.32		1.10	2.55		
AS	DER332 - 100phr V140, 30phr LP3, r8	E,GM,T	2.27	1.13	2.55			7.5 @ 2, 11.2 @ 2.5
AS	DER332 - 100phr V140, 30phr LP3, r9	E,GM,T	2.36		1.16	2.74		9.6 @ 2
AS	DER332 - 100phr V140, 50phr LP3, r8	E,GM,T	2.32		1.13	2.63		12.0 @ 2
AS	DER332 - 50phr V140, 50phr St. Helens Ash,60°C	E,GM,?	2.43		1.94	6.24		
CRC	Duraluminin 17S		6.32	3.13	2.79	17.63	0.34	
AS	Duxseal	JM	1.49		1.68	2.50		13.3 @ 0.5
AS	E.pox.e glue, EPX-1 or EPX-2, 100phA of B	Loc	2.44		1.10	2.68		8.4 @ 5
AS	Eccosorb - CR 124 - 2PHX of Y	EC	2.62		4.59	12.01		9.4 @ 5
AH	Ecosorb - MF 110	EC	2.61		1.60	4.20		
AH	Ecosorb - MF 112	EC	2.40		2.19	5.25		
AH	Ecosorb - MF 114	EC	2.29		2.90	6.65		
AH	Ecosorb - MF 116	EC	2.45		3.69	9.02		
AH19	Ecosorb - MF 124	EC	2.60		4.50	12.0		
AS	Eccosorb - MF 190	EC	2.67		4.45	11.88		15.9 @ 4
	Epon - 828, mpda	Sh,D	2.829	1.23	1.21	3.4	0.45	
	Epotek - 301	Wa	2.64		1.08	2.85		
	Epotek - 330	Wa	2.57		1.14	2.94		
	Epotek - H70S	Wa	2.91		1.68	4.88		
AS	Epotek - V6, 10phA of B, r6	Wa	2.61		1.23	3.21		4.5 @ 2
AS	Epotek - V6, 10phA of B, r7	Wa	2.55		1.23	3.14		8 @ 2
AS	Epotek - V6, 10phA of B, 20phA LP3, r6	Wa,T	2.60		1.25	3.25		6 @ 2
AS	Epotek - V6, 10phA of B, 20phA LP3, r7	Wa,T	2.55		1.26	3.22		6 @ 2
DYNA	Fused silica	Dyna	5.70	3.75	2.20	12.55	0.17	6.2e-5 @ 2
M	Germanium, mp=937.4°C, transparent to infrared	C	5.41		5.47	29.6		
	Glass - corning 0215 sheet	Corn	5.66		2.49	14.09		
	Glass - crown	RG	5.1	2.8	2.24	11.4	0.28	



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	Glass - FK3	Schott	4.91	2.85	2.26	11.1	0.245	
	Glass - FK6 (large minimum order)	Schott	4.43	2.54	2.28	10.1	0.25	
AE	Glass - flint		4.5		3.6	16.0		
	Glass - macor machinable code 9658	Lee	5.51		2.54	14.0		
	Glass - pyrex	Corn	5.64	3.28	2.24	13.1	0.24	
AE	Glass - quartz		5.5		2.2	12.1		
AE	Glass - silica		5.9		2.2	13.0		
	Glass - soda lime		6.00		2.24	13.4		
	Glass - TIK	Schott	4.38		2.38	10.5		
RB	Glucose		3.20		1.56	5.0		
CRC	Gold - hard drawn		3.24	1.20	19.7	63.8	0.42	
EM	Granite		6.5	2.7		17.6		
M	Hafnium, mp=2150°C, used in reactor control rods		3.84		13.29	51.0		
	Hydrogen, solid at 4.2K		2.19		0.089	0.19		
AS	Hysol - CAW795/25 phr HW796 50°C		2.70		1.18	3.19		17.0 @ 5
BB	Hysol - C8-4143/3404	H	2.85		1.58	4.52		
BB	Hysol - C9-4183/3561	H	2.92		1.48	4.3		
BB	Hysol - C9-4183/3561, 15phe C5W	H,Li	2.62		1.80	4.7		
BB	Hysol - C9-4183/3561, 30phe C5W	H,Li	2.49		2.14	5.33		
BB	Hysol - C9-4183/3561, 45phe C5W	H,Li	2.30		2.66	6.10		
BB	Hysol - C9-4183/3561, 57.5phe C5W	H,Li	2.16		3.27	7.04		
AS	Hysol - EE0067/H3719 76°C, formerly C9-H905	H	2.53		1.93	4.88		22.4 @ 5
AS	Hysol - EE4183/HD3469 90°C	H	2.99		1.57	4.70		15.1 @ 5
AS	Hysol - EE4183/HD3469, 20phr 3: @ h^ Alumina	H	3.07		1.76	5.40		14.9 @ 5
	Hysol - ES 4212, 1:1	H	2.32		1.50	3.49		
	Hysol - ES 4412, 1:1	H	2.02		1.68	3.39		
BB	Hysol R8-2038/3404	H	2.59		1.18	3.05		
BB	Hysol R9-2039/3404	H	2.59		1.13	2.92		
BB	Hysol R9-2039/3469	H	2.61		1.17	3.07		
BB	Hysol R9-2039/3561	H	2.53		1.18	3.0		



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RLB	Hysol R9-2039/3561, 427phr WO3	H,A	2.15		3.51	7.54		33.5 @ 5
	Ice		3.99	1.98	0.917	3.66	0.34	
	Inconel		5.7	3.0	8.28	47.2	0.31	
	Indium	I	2.56		7.3	18.7		
	Iron		5.9	3.2	7.69	46.4	0.29	
	Iron - cast		4.6	2.6	7.22	33.2	0.27	
	Lead		2.2	0.7	11.2	24.6	0.44	
	Lead metaniobate	Kera	3.30		6.2	20.5		Q =15
	Lithium niobate - 36°C, rotated Y-cut	CT	7.08		4.7	33.0		
	Magnesium - various types listed in ref "M"		5.8	3.0	1.738	10.0	0.32	
AE	Marble		3.8		2.8	10.5		
	Molybdenum		6.3	3.4	10.0	63.1	0.29	
	Monel		5.4	2.7	8.82	47.6	0.33	
	Nickel		5.6	3.0	8.84	49.5	0.30	
M	Niobium, m.p.= 2468°C	C	4.92	2.10	8.57	42.2	0.39	
AS	Paraffin		1.94		0.91	1.76		10.5 @ 1
RLB	Phillips 66 "Crystallor"	Ph	2.17	1.03	0.83	1.79	0.36	5.3 @ 5
CRC	Platinum		3.26	1.73	21.4	69.8	0.32	
RLB	Poco - DFP-1	Uno	3.09	1.73	1.81	5.61	0.27	1.2 @ 5
RLB	Poco - DFP-1C	Uno	3.20	1.81	3.20	11.0	0.31	2.0 @ 5
	Polyester casting resin	Tap	2.29		1.07	2.86		
AE	Porcelain		5.9		2.3	13.5		
	PSN, potassium sodium niobate		6.94		4.46	31.0		
	Pressed graphite		2.4		1.8	4.1		
	PZT 5H - Vernitron	EBL	4.44		7.43	33.0		
AS	PZT - Murata	Mura	4.72		7.95	37.5		
	PVDF	3M	2.30		1.79	4.2		Q =10
KF	Quartz - X-cut	VF	5.75	2.2	2.65	15.3	0.42	
AS	Resin Formulators - RF 5407	EV	3.06		2.16	6.61		14.9 @ 5
AS	Resin Formulators - RF 5407, 30 PHR LP3	EV	2.56		1.92	4.92		54.7 @ 5
M	Rubidium, mp=38.9, a "getter" in vacuum tubes	C	1.26		1.53	1.93		



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M	Salt - NaCl, crystalline, X- direction		4.78		2.17	10.37		
PK	Sapphire (aluminum oxide) Z-axis		11.1	6.04	3.99	44.3		
DP	Scotch tape - 0.0025" thick	3M	1.9		1.16	2.08		
AS	Scotchcast XR5235, 38 pha B, rt cure	3M	2.48		1.49	3.70		3.8 @ 1.3
	Scotchply SP1002 (a laminate with fibers)	3M	3.25		1.94	6.24		
	Scotchply XP 241	3M	2.84		0.65	1.84		
AS	Silicon - very anisotropic, values are approx.		8.43	5.84	2.34	19.7		
PK	Silicon carbide		13.06	7.27	3.217	42.0		
PK	Silicon nitride		11.0	6.25	3.27	36.0	0.26	
	Silver		3.6	1.6	10.6	38.0	0.38	
AS	Silver epoxy, e-solder 3022	Acme	1.9	0.98	2.71	5.14	0.32	16 @ 2
AE	Slate		4.5		3.0	13.5		
	Steel - mild		5.9	3.2	7.80	46.0	0.29	
	Steel - stainless 347, Zs = 24.5 MRayl		5.79	3.10	7.89	45.7	0.30	
	Stycast - 1264, rt cure	EC	2.22		1.19	2.64		
RLB	Stycast - 1264, 45pha, 600pha W, r6	EC,C	1.65		4.71	7.77		29.7 @ 5
RLB	Stycast - 1264, 45pha, 800pha W, r6	EC,C	1.57		5.50	8.65		46.5 @ 5
RLB	Stycast - 1264, 45pha, vac. impreg. W, rt	EC,C	1.71		6.03	10.4		34.1 @ 5
	Stycast - 1267	EC	2.57		1.16	3.00		4.6 @ 3.0
JA	Stycast - 1970, costs \$109.00/lb	EC	3.2		1.90	6.08		
AS	Stycast - 2651-40 9phr catalyst 9, rt cure	EC	2.77		1.5	4.16		
AS	Stycast - 2651-40 9phr catalyst 9, 10phr SiC	EC,C	2.88		1.57	4.53		
AS	Stycast - 2651-40 9phr catalyst 9, 20phr SiC	EC,C	2.95		1.63	4.82		
AS	Stycast - 2651-40 9phr catalyst 9, 25phr SiC	EC,C	2.90	1.50	1.67	4.83	0.32	
	Stycast - 2741, 1:1	EC	2.29		1.17	2.68		
M	Sulphur - 9 isotropic forms exist, mp 112°C		1.35		2.0	2.7		
M	Tantalum - mp=2996°C, very inert, hard	C	4.10	2.90	16.6	54.8		
AS	Tapox epoxy	Tap	2.48		1.11	2.76		
AS	Techform EA700, brittle material	Tech	2.63		1.20	3.14		4.6 @ 2, 5.2 @ 2.5
	Teflon		1.39		2.14	2.97		3.9 @ 5



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M	Thorium - mp=1700°C, fissionable, high melting oxide		2.40	1.56	11.3	33.2	0.134	
	Tin		3.3	1.7	7.3	24.2	0.31	
	Titanium - mp=1725°C		6.1	3.1	4.48	27.3	0.32	
M,PK	Titanium carbide - mp=3140°C	C	8.27	5.16	5.15	42.6		
	Tracon - 401 ST	Tr	2.97		1.62	4.82		
	Tracon - 2135 D	Tr	2.45		1.03	2.52		
	Tracon - 2143 D	Tr	2.37		1.05	2.50		
	Tracon - 2162 D	Tr	2.02		1.19	2.41		
	Tracon - 3011	Tr	2.12		1.2	2.54		
	Tungsten	C	5.2	2.9	19.4	101.0	0.27	
	Unobtainium (properties are proprietary!)							
	Uranium	C	3.4	2.0	18.5	63.0	0.24	
M	Uranium dioxide	C	5.18			10.96	56.7	
M	Vanadium, mp=1890C	C	6.00	2.78	6.03	36.2	0.36	
PK	Wood - balsa		0.80		0.10	0.08		Q = 1.5
KF	Wood - cork		0.5		0.24	0.12		
PK	Wood - cork		1.150		0.13	0.15		Q = 2.0
KF	Wood - oak		4.0		0.72	2.9		
KF	Wood - pine		3.5		0.45	1.57		
	Zinc (often very granular)		4.2	2.4	7.0	29.6	0.26	
	Zinc oxide		6.40	2.95	5.68	36.4	0.37	
M	Zircaloy		4.72	2.36	9.36	44.2		
M	Zirconium, mp=1852°C, used in poison ivy lotion	C	4.65	2.25	6.48	30.1	0.35	