COMMONLY USED MATERIALS[1]

Material	Formula	Density g/cm^3	M.P.[2] °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn-cm)
Aluminum	Al	2.699	660				.06027
Beryllia	BeO	3.02	2550	Be	36.03	50.0	.07287
				O	63.97	50.0	.07287
Beryllium	Be	1.847	1285				.12348
Bismuth	Bi	9.78	271				.02820
Boral[3] (without Al clad, 65 wt% Al, 35 wt% B_4C)	B_4C-Al	2.53		B	27.4	45.4	.04036
				C	7.6	11.4	.01008
				Al	65.0	43.2	.03837
Boral (with Al clad, 1/4" sheet)		2.67		B	15.7	30.3	.02334
				C	4.3	7.6	.00575
				Al	80.0	61.9	.04765
Borax	$Na_2B_4O_7 \cdot 10H_2O$	1.73	75	Na	12.06	4.65	.00547
				B	11.34	9.30	.01093
				O	71.32	39.54	.04646
				H	5.29	46.51	.05466
Boric Acid	H_3BO_3	1.435	184	H	4.89	42.86	.04195
				B	17.48	14.28	.01398
				O	77.63	42.86	.04195
Boron	B	2.48	2000				.13821

(1) C. R. Tipton, et al, Reactor Handbook, Vol. I, 1960. Most material was obtained from this reference. References for other material will be listed.

(2) Melting Point. For plastics this column will designate the recommended maximum continuous service temperature.

(3) Neutron absorption in Boral based on homogeneous boron distribution will be in error. Effectiveness of Boral depends upon B_4C particle size (see Nucleonics, Vol. 16, pp 91-94, 1958).

Material	Formula	Density g/cm^3	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn-cm)
Boron Carbide	B_4C	2.54	2450	B	78.26	80.0	.11078
				C	21.74	20.0	.02770
Boron Stainless Steel (1 Wt% Boron in 304 L)		7.87		B	1.0	4.9	.00439
				Fe	68.0	64.8	.05773
				Cr	19.0	19.4	.01733
				Ni	12.0	10.9	.00969
Boron Steel (1 Wt%)		7.87	1540	B	1.0	4.9	.00439
				Fe	98.8	94.2	.08388
				C	0.2	0.9	.00079
Borated Polyethylene (10 Wt% B as B_4C)		1.00		B	10.0	4.7	.00558
				C	77.4	32.5	.03885
				H	12.6	62.8	.07505
Bricks (common silica)		1.8	1680-1700	Al	0.5	0.4	.00021
				Ca	1.4	0.7	.00039
				Fe	0.7	0.3	.00014
				O	52.5	66.3	.03556
				Si	44.9	32.3	.01733
Bricks (fire clay)		2.1	1680-1740	Al	21.2	16.1	.00567
				Ca	0.7	0.4	.00013
				Fe	1.4	0.5	.00018
				O	49.7	63.6	.02245
				Mg	.6	.5	.00018
				Si	25.2	18.4	.00650
				Ti	1.2	0.5	.00018
Cadmium	Cd	8.65	321				.04637
Cadmium Nitrate	$Cd(NO_3)_2 \cdot 4H_2O$	2.46	59.5	Cd	36.44	4.76	.00480
				H	2.61	38.10	.03844
				N	9.08	9.52	.00961
				O	51.87	47.62	.04805
Carbon	C	1.71(1)	3700				.08578

(1) Average density of reactor grade - Hanford

Material	Formula	Density g/cm3	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn-cm)
Carbon Tetrachloride	CCl_4	1.6	-23	C	7.81	20.0	.00627
				Cl	2.19	80.0	.02507
Cellulose	$(C_6H_{10}O_5)_n$	1.45		C	44.44	28.57	.03233
				H	6.22	47.62	.05431
				O	49.34	23.81	.02694
Chromium	Cr	7.19	1875				.08331
Concrete (common Portland)(1)		2.3		Al	3.4	2.1	.00175
				Ca	4.4	1.9	.00152
				Fe	1.4	0.4	.00035
				H	1.0	16.9	.01375
				O	53.2	56.2	.04608
				Si	33.7	20.4	.01663
				Na	2.9	2.1	.00175
Deuterium Oxide	D_2O	1.1054^{200}		D	20.11	66.67	.06651
				O	80.89	33.33	.03325
Felt (in KKD-1 or LLD-1)		0.185		C	43.46	31.6	.00403
				H	4.42	38.6	.00489
				O	34.47	18.8	.00240
				N	17.65	11.0	.00140
Gadolinium	Gd	7.868	1350				.03015
Glass, Foam(2)		0.128		B	1.5	2.7	.00011
				H	0.1	1.3	.00005
				O	53.4	63.3	.00262
				Si	27.9	18.8	.00109
				Na	16.1	13.3	.00055
				S	1.0	0.6	.00003

(1) See Reactor Handbook for other shielding concretes.

(2) From Y-KC-106

Material	Formula	Density g/cm^3	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn-cm)
Glass, plate (silica)		2.4	1425	Ca	10.7	5.6	.00387
				O	46.0	60.4	.04156
				Si	33.7	25.2	.01733
				Na	9.6	8.8	.00607
Glass, Pyrex		2.23	820	Al	1.0	0.7	.00053
				B	3.7	6.5	.00459
				O	53.5	63.8	.04492
				Si	37.7	25.6	.01802
				Na	4.1	3.4	.00238
Graphite	(see Carbon)						
Iron	(see Steel)						
Kernite	$Na_2B_4O_7 \cdot 4H_2O$	1.95		Na	16.83	8.0	.00860
				B	15.82	16.0	.01720
				O	64.40	44.0	.04729
				H	2.95	32.0	.03439
Kaowool		(2.65) To 0.192 bulk	1260(1)	Al	23.9	18.0	.00102
				Fe	.9	.3	.00002
				O	49.9	63.6	.00361
				Si	24.3	17.6	.00100
				Ti	1.0	.5	.00002
Kynar	CF_2CH_2	1.76	340	C	37.51	33.33	.03312
				H	3.15	33.33	.03312
				F	59.34	33.33	.03312
Lead	Pb	11.34	327				.03298
Lithium	Li	0.534	186				.04636
Lucite	$C_5H_8O_2$	1.2	185	C	59.99	33.33	.03611
				H	8.05	53.34	.05777
				O	31.96	13.33	.01444

(1) Recommended Maximum Temperature Usage

Material	Formula	Density g/cm³	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn/cm)
Magnesium	Mg	1.74	650				.04313
Magnesium Oxide	MgO	3.22	2800	Mg	60.30	50.00	.04814
				O	39.70	50.00	.04814
Masonite	$C_6H_{10}O_5$	1.3		C	44.44	28.57	.02898
				H	6.22	47.62	.04831
				O	49.34	23.81	.02415
Molybdenum	Mo	10.22	2622				.06418
Nickel	Ni	8.90	1455				.09133
Neoprene	$(C_4H_5Cl)_n$	1.23		C	54.27	40.0	.03348
				H	5.69	50.0	.04185
				Cl	40.04	10.0	.00837
Nylon	(see Polyamides)						
Oil, hydraulic	$C_{40}H_{33}O_4Cl_6P$	1.28		C	58.49	47.62	.03755
				H	4.05	39.29	.03098
				O	7.79	4.76	.00376
				Cl	25.90	7.14	.00563
				P	3.77	1.19	.00094
Lard Oil	$C_{10}H_{18}O$	0.915		C	77.87	34.48	.03574
				H	11.76	62.07	.06433
				O	10.37	3.45	.00357
Paraffin	$C_{25}H_{52}$	0.90	48	C	85.14	32.47	.03844
				H	14.86	67.53	.07995
Phenolformaldehyde (Bakelite, Durez, Resinox - composition depends upon filler used) With no Filler	$(C_6H_5O)_n$	1.27	121	C	79.98	53.85	.05094
				H	4.80	38.46	.03640
				O	15.22	7.69	.00728

Material	Formula	Density g/cm3	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ barn-cm)
Polyamides (Nylon)	$(C_6H_{11}ON)_n$	1.14	74	C	63.68	31.58	.03642
				H	9.80	57.90	.06677
				N	12.38	5.26	.00607
				O	14.14	5.26	.00607
Polyester (Dacron, Duraplex, Glyptal, Mylar - Many different compositions)				C	54 - 74		
				H	6 - 9		
				O	18 - 40		
Polyethylene	$(CH_2)_n$	0.92	99	C	85.63	33.33	.03952
				H	14.37	66.67	.07903
Polystyrene	$(CH)_n$	1.06	66	C	92.26	50.0	.04905
				H	7.74	50.0	.04905
Polysulfide	$(C_2H_4S_4)_n$	1.34		C	15.37	20.0	.01033
				H	2.58	40.0	.02066
				S	82.05	40.0	.02066
Polyvinyl Chloride	$(C_2H_3Cl)_n$	1.65	52	C	38.44	33.33	.03181
				H	4.84	50.00	.04772
				Cl	56.72	16.67	.01591
Pyrex (see glass)							
Stainless Steel	304 L	7.93	1450	Fe	74.0	73.3	.06331
				Cr	18.0	19.2	.01654
				Ni	8.0	7.5	.00651
1 Wt% Boron	(see Boron Steel)						
Steel (high strength)		7.84		Fe	98.0	98.1	.08289
				Ni(1)	2.0	1.9	.00161
Tantalum	Ta	16.6	2996				.05527

(1) All other elements were added as nickel which has an average total cross section of these elements.

Material	Formula	Density g/cm3	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn-cm)
Teflon	C_2F_4	2.20	204	C	24.02	33.33	.02651
				F	75.98	66.67	.05301
Thorium	Th	11.72	1750				.03043
Thorium Dioxide	ThO_2	10.03	3000	Th	87.88	33.33	.02289
				O	12.12	66.67	.04577
Titanium	Ti	4.51	1670				.05673
Titanium Dioxide	TiO_2	4.2	1640	Ti	59.95	33.33	.03167
				O	40.05	66.67	.06334
Tributyl Phosphate	$(C_4H_9O)_3PO$	0.973	-80	C	54.12	27.27	.02650
				H	10.22	61.37	.05962
				O	24.03	9.09	.00883
				P	11.63	2.27	.00221
Vermiculite(1)		0.134		Al	7.8	5.1	.00023
				Fe	6.3	2.0	.00009
				H	1.0	17.2	.00081
				K	5.8	2.6	.00012
				Mg	12.7	9.1	.00042
				O	48.1	52.6	.00242
				Si	18.3	11.4	.00052
Water	H_2O	1.00	0	H	11.19	66.67	.06689
				O	88.81	33.33	.03344
Wood, Hard		0.64					
Zirconium	Zr	6.51	1852				.04251

(1) From Y-KC-109

Material	Formula	Density g/cm^3	M.P. °C	Composition Element	Weight %	Atomic %	Atomic Density Atoms/ (barn-cm)
Zircaloy-2	Zr-2	6.55		Zr	98.26	98.35	.04251
				Sn	1.45	0.12	.00048
				Cr	0.10	0.18	.00008
				Ni	0.05	0.08	.00003
				Fe	0.13	0.21	.00009
				N	0.01	0.06	.00003