

EMISSION CHART

Non-Metal and
Metal Materials



NON-METAL MATERIALS

	Temp F° (C°)	Emissivity
Adobe		
	68 (20)	0.9
Asbestos		
Board	100 (38)	0.96
Cement	32-392 (0-200)	0.96
Cement, Red	2500 (1371)	0.67
Cement, White	2500 (1371)	0.65
Cloth	199 (93)	0.9
Paper	100-700 (38-371)	0.93
Slate	68 (20)	0.97
Asphalt, pavement	100 (38)	0.93
Asphalt, tar paper	68 (20)	0.93
Basalt		
	68 (20)	0.72
Brick		
Red, rough	70 (21)	0.93
Gault Cream	2500-5000 (1371-2760)	.26-.30
Fire Clay	2500 (1371)	0.75
Light Buff	1000 (538)	0.8
Lime Clay	2500 (1371)	0.43
Fire Brick	1832 (1000)	.75-.80
Magnesite, Refractory	1832 (1000)	0.38
Grey Brick	2012 (1100)	0.75
Silica, Glazed	2000 (1093)	0.88
Silica, Unglazed	2000 (1093)	0.8
Sandlime	2500-5000 (1371-2760)	.59-.63
Carborundum		
	1850 (1010)	0.92
Ceramic		
Alumina on Inconel	800-2000 (427-1093)	.69-.45
Earthenware, Glazed	70 (21)	0.9
Earthenware, Matte	70 (21)	0.93
Greens No. 5210-2C	200-750 (93-399)	.89-.82
Coating No. C20A	200-750 (93-399)	.73-.67
Porcelain	72 (22)	0.92
White Al ₂ O ₃	200 (93)	0.9
Zirconia on Inconel	800-2000 (427-1093)	.62-.45
Clay		
	68 (20)	0.39
Fired	158 (70)	0.91
Shale	68 (20)	0.69
Tiles, Light Red	2500-5000 (1371-2760)	.32-.34
Tiles, Red	2500-5000 (1371-2760)	.40-.51
Tiles, Dark Purple	2500-5000 (1371-2760)	0.78
Concrete		
Rough	32-2000 (0-1093)	0.94
Tiles, Natural	2500-5000 (1371-2760)	.63-.62
Brown	2500-5000 (1371-2760)	.87-.83
Black	2500-5000 (1371-2760)	.94-.91

	Temp F° (C°)	Emissivity
Cotton Cloth		
	68 (20)	0.77
Dolomite Lime		
	68 (20)	0.41
Emery Corundum		
	176 (80)	0.86
Glass		
Convex D	212 (100)	0.8
Convex D	600 (316)	0.8
Convex D	932 (500)	0.76
Nonex	212 (100)	0.82
Nonex	600 (316)	0.82
Nonex	932 (500)	0.78
Smooth	32-200 (0-93)	.92-.94
Granite		
	70 (21)	0.45
Gravel		
	100 (38)	0.28
Gypsum		
	68 (20)	.80-.90
Ice, Smooth		
	32 (0)	0.97
Ice, Rough		
	32 (0)	0.98
Lacquer		
Black	200 (93)	0.96
Blue, on Al Foil	100 (38)	0.78
Clear, on Al Foil (2 coats)	200 (93)	.08-.09
Clear, on Bright Cu	200 (93)	0.66
Clear, on Tarnished Cu	200 (93)	0.64
Red, on Al Foil (2 coats)	100 (38)	.60-.74
White	200 (93)	0.95
White, on Al Foil (2 coats)	100 (38)	.69-.88
Yellow, on Al Foil (2 coats)	100 (38)	.57-.79
Lime Mortar		
	100-500 (38-260)	.90-.92
Limestone		
	100 (38)	0.95
Marble, White		
Smooth, White	100 (38)	0.56
Polished Grey	100 (38)	0.75
Mica		
	100 (38)	0.75
Oil on Nickel		
0.001" Film	72 (22)	0.27
0.002" Film	72 (22)	0.46
0.005" Film	72 (22)	0.72
Thick" Film	72 (22)	0.82
Oil, Linseed		
On Al Foil, uncoated	250 (121)	0.09
On Al Foil, 1 coat	250 (121)	0.56
On Al Foil, 2 coats	250 (121)	0.51
On Polished Iron, .001 Film	100 (38)	0.22
On Polished Iron, .002 Film	100 (38)	0.45
On Polished Iron, .004 Film	100 (38)	0.65
On Polished Iron, Thick Film	100 (38)	0.83

	Temp F° (C°)	Emissivity
Paints		
Blue, Cu ₂ O ₃	75 (24)	0.94
Black, CuO	75 (24)	0.96
Green, Cu ₂ O ₃	75 (24)	0.92
Red, Fe ₂ O ₃	75 (24)	0.91
White, Al ₂ O ₃	75 (24)	0.94
White, Y ₂ O ₃	75 (24)	0.9
White, ZnO	75 (24)	0.95
White, MgCO ₃	75 (24)	0.91
White, ZrO ₂	75 (24)	0.95
White, ThO ₂	75 (24)	0.9
White, MgO	75 (24)	0.91
White, PbCO ₃	75 (24)	0.93
Yellow, PbO	75 (24)	0.9
Yellow, PbCrO ₄	75 (24)	0.93
Paints, Aluminium		
	100 (38)	.27-.67
10% Al	100 (38)	0.52
26% Al	100 (38)	0.3
Dow XP-310	200 (93)	0.22
Paints, Bronze		
	Low	.34-.80
Gum Varnish (2 coats)	70 (21)	0.53
Gum Varnish (3 coats)	70 (21)	0.5
Cellulose Binder (2 coats)	70 (21)	0.34
Paints, Oil		
All colours	200 (93)	.92-.96
Black	200 (93)	0.92
Black Gloss	70 (21)	0.9
Camouflage Green	125 (52)	0.85
Flat Black	80 (27)	0.88
Flat White	80 (27)	0.91
Grey-Green	70 (21)	0.95
Green	200 (93)	0.95
Lamp Black	209 (98)	0.96
Red	200 (93)	0.95
White	200 (93)	0.94
Quartz, Rough, Fused		
	70 (21)	0.93
Glass, 1.98 mm	540 (282)	0.9
Glass, 1.98 mm	1540 (838)	0.41
Glass, 6.88 mm	540 (282)	0.93
Glass, 6.88 mm	1540 (838)	0.47
Opaque	570 (299)	0.92
Opaque	1540 (838)	0.68
Red Lead		
	212 (100)	0.93
Rubber, Hard		
	74 (23)	0.94
Rubber, Soft, Grey		
	76 (24)	0.86
Sand		
	68 (20)	0.76
Sandstone		
	100 (38)	0.67
Sandstone, Red		
	100 (38)	.60-.83
Sawdust		
	68 (20)	0.75
Shale		
	68 (20)	0.69

	Temp F° (C°)	Emissivity
Silica, Glazed		
	1832 (1000)	0.85
Silica, Unglazed		
	2012 (1100)	0.75
Silicon Carbide		
	300-1200 (149-649)	.83-.96
Silk Cloth		
	68 (20)	0.78
Slate		
	100 (38)	.67-.80
Snow, Fine Particles		
	20 (-7)	0.82
Snow, Granular		
	18 (-8)	0.89
Soil		
Surface	100 (38)	0.38
Black Loam	68 (20)	0.66
Plowed Field	68 (20)	0.38
Soot		
Acetylene	75 (24)	0.97
Camphor	75 (24)	0.94
Candle	250 (121)	0.95
Coal	68 (20)	0.95
Stonework		
	100 (38)	0.93
Water		
	100 (38)	0.67
Waterglass		
	68 (20)	0.96
Wood		
	Low	.80-.90
Beech Planed		
	158 (70)	0.94
Oak, Planed		
	100 (38)	0.91

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Alloys		
20-Ni, 24-CR, 55-FE, Oxid.	392 (200)	0.9
20-Ni, 24-CR, 55-FE, Oxid.	932 (500)	0.97
60-Ni, 12-CR, 28-FE, Oxid.	518 (270)	0.89
60-Ni, 12-CR, 28-FE, Oxid.	1040 (560)	0.82
80-Ni, 20-CR, Oxidised	212 (100)	0.87
80-Ni, 20-CR, Oxidised	1112 (600)	0.87
80-Ni, 20-CR, Oxidised	2372 (1300)	0.89
Aluminium		
Unoxidised	77 (25)	0.02
Unoxidised	212 (100)	0.03
Unoxidised	932 (500)	0.06
Oxidised	390 (199)	0.11
Oxidised	1110 (599)	0.19
Oxidised at 1110°F (599°C)	390 (199)	0.11
Oxidised at 1110°F (599°C)	1110 (599)	0.19
Heavily Oxidised	200 (93)	0.2
Heavily Oxidised	940 (504)	0.31
Highly Polished	212 (100)	0.09
Roughly Polished	212 (100)	0.18
Commercial Sheet	212 (100)	0.09
Highly Polished Plate	440 (227)	0.04
Highly Polished Plate	1070 (577)	0.06
Bright Rolled Plate	338 (170)	0.04
Bright Rolled Plate	932 (500)	0.05
Alloy A3003, Oxidised	600 (316)	0.4
Alloy A3003, Oxidised	900 (482)	0.4
Alloy 1100-0	200-800 (93-427)	0.05
Alloy 24ST	75 (24)	0.09
Alloy 24ST, Polished	75 (24)	0.09
Alloy 75ST	75 (24)	0.11
Alloy 75ST, Polished	75 (24)	0.08
Bismuth, Bright		
	176 (80)	0.34
Bismuth, Unoxidised		
	77 (25)	0.05
	212 (100)	0.06
Brass		
73% Cu, 27% Zn, Polished	476 (247)	0.03
73% Cu, 27% Zn, Polished	674 (357)	0.03
62% Cu, 37% Zn, Polished	494 (257)	0.03
62% Cu, 37% Zn, Polished	710 (377)	0.04
83% Cu, 17% Zn, Polished	530 (277)	0.03
Matte	68 (20)	0.07
Burnished to Brown Colour	68 (20)	0.4
Cu-Zn, Brass Oxidised	392 (200)	0.61
Cu-Zn, Brass Oxidised	752 (400)	0.6
Cu-Zn, Brass Oxidised	1112 (600)	0.61
Unoxidised	77 (25)	0.04
Unoxidised	212 (100)	0.04
Cadmium	77 (25)	0.02
Carbon		
Lampblack	77 (25)	0.95
Unoxidised	77 (25)	0.81
Unoxidised	212 (100)	0.81
Unoxidised	932 (500)	0.79
Candle Soot	250 (121)	0.95
Filament	500 (260)	0.95
Graphitized	212 (100)	0.76
Graphitized	572 (300)	0.75
Graphitized	932 (500)	0.71

	Temp F° (C°)	Emissivity
Chromium		
	100 (38)	0.08
	1000 (538)	0.26
Chromium, Polished		
	302 (150)	0.06
Cobalt, Unoxidised		
	932 (500)	0.13
	1832 (1000)	0.23
Columbium, Unoxidised		
	1500 (816)	0.19
	2000 (1093)	0.24
Copper		
Cuprous Oxide	100 (38)	0.87
Cuprous Oxide	500 (260)	0.83
Cuprous Oxide	1000 (538)	0.77
Black, Oxidised	100 (38)	0.78
Etched	100 (38)	0.09
Matte	100 (38)	0.22
Roughly Polished	100 (38)	0.07
Polished	100 (38)	0.03
Highly Polished	100 (38)	0.02
Rolled	100 (38)	0.64
Rough	100 (38)	0.74
Molten	1000 (538)	0.15
Molten	1970 (1077)	0.16
Molten	2230 (1221)	0.13
Nickel Plated	100-500 (38-260)	0.37
Dow Metal		
	0.4-600 (-18-316)	0.15
Gold		
Enamel	212 (100)	0.37
Plate on .0005 Silver	200-750 (93-399)	.11-.14
Plate on .0005 Nickel	200-750 (93-399)	.07-.09
Polished	100-500 (38-260)	0.02
Polished	1000-2000 (538-1093)	0.03
Haynes Alloy C,		
Oxidised	600-2000 (316-1093)	.90-.96
Haynes Alloy 25,		
Oxidised	600-2000 (316-1093)	.86-.89
Haynes Alloy X,		
Oxidised	600-2000 (316-1093)	.85-.88
Inconel Sheet		
	1000 (538)	0.28
	1200 (649)	0.42
	1400 (760)	0.58
Inconel X, Polished		
	75 (24)	0.19
Inconel B, Polished		
	75 (24)	0.21
Iron		
Oxidised	212 (100)	0.74
Oxidised	930 (499)	0.84
Oxidised	2190 (1199)	0.89
Unoxidised	212 (100)	0.05
Red Rust	77 (25)	0.7
Rusted	77 (25)	0.65
Liquid	2760-3220 (1516-1771)	.42-.45

	Temp F° (C°)	Emissivity
Cast Iron		
Oxidised	390 (199)	0.64
Oxidised	1110 (599)	0.78
Unoxidised	212 (100)	0.21
Strong Oxidation	40 (104)	0.95
Strong Oxidation	482 (250)	0.95
Liquid	2795 (1535)	0.29
Wrought Iron		
Dull	77 (25)	0.94
Dull	660 (349)	0.94
Smooth	100 (38)	0.35
Polished	100 (38)	0.28
Lead		
Polished	100-500 (38-260)	.06-.08
Rough	100 (38)	0.43
Oxidised	100 (38)	0.43
Oxidised at 1100	100 (38)	0.63
Gray Oxidised	100 (38)	0.28
Magnesium		
	100-500 (38-260)	.07-.13
Magnesium Oxide		
	1880-3140 (1027-1727)	.16-.20
Mercury		
	32 (0)	0.09
	77 (25)	0.1
	100 (38)	0.1
	212 (100)	0.12
Molybdenum		
	100 (38)	0.06
	500 (260)	0.08
	1000 (538)	0.11
	2000 (1093)	0.18
Monel, Ni-Cu		
	392 (200)	0.41
	752 (400)	0.44
	1112 (600)	0.46
Monel, Ni-Cu Oxidised		
	68 (20)	0.43
Monel, Ni-Cu Oxid. at 1110degF		
	1110 (599)	0.46
Nickel		
Polished	100 (38)	0.05
Oxidised	100-500 (38-260)	.31-.46
Unoxidised	77 (25)	0.05
Unoxidised	212 (100)	0.06
Unoxidised	932 (500)	0.12
Unoxidised	1832 (1000)	0.19
Electrolytic	100 (38)	0.04
Electrolytic	500 (260)	0.06
Electrolytic	1000 (538)	0.1
Electrolytic	2000 (1093)	0.16
Nickel Oxide		
	1000-2000 (538-1093)	.59-.86
Palladium Plate (.00005 on .0005 silver)		
	200-750 (93-399)	.16-.17
Platinum		
	100 (38)	0.05
	500 (260)	0.05
	1000 (538)	0.1

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	Temp F° (C°)	Emissivity
Platinum, Black		
	100 (38)	0.93
	500 (260)	0.96
	2000 (1093)	0.97
Platinum Oxidised at 1100		
	500 (260)	0.07
	1000 (538)	0.11
Rhodium Flash (0.0002 on 0.0005 Ni)		
	200-700 (93-371)	.10-.18
Silver		
Plate (0.0005 on Ni)	200-700 (93-371)	.06-.07
Polished	100 (38)	0.01
Polished	500 (260)	0.02
Polished	1000 (538)	0.03
Polished	2000 (1093)	0.03
Steel		
Cold Rolled	200 (93)	.75-.85
Ground Sheet	1720-2010 (938-1099)	.55-.61
Polished Sheet	100 (38)	0.07
Polished Sheet	500 (260)	0.1
Polished Sheet	1000 (538)	0.14
Mild Steel, Polished	75 (24)	0.1
Mild Steel, Smooth	75 (24)	0.12
Mild Steel, liquid	2910-3270 (1599-1793)	0.28
Steel, Unoxidised	212 (100)	0.08
Steel, Oxidised	77 (25)	0.8
Steel Alloys		
Type 301, Polished	75 (24)	0.27
Type 301, Polished	450 (232)	0.57
Type 301, Polished	1740 (949)	0.55
Type 303, Oxidised	600-2000 (316-1093)	.74-.87
Type 310, Rolled	1500-2100 (816-1149)	.56-.81
Type 316, Polished	75 (24)	0.28
Type 316, Polished	450 (232)	0.57
Type 316, Polished	1740 (949)	0.66
Type 321	200-800 (93-427)	.27-.32
Type 321 Polished	300-1500 (149-815)	.18-.49
Type 321 w/BK Oxide	200-800 (93-427)	.66-.76
Type 347, Oxidised	600-2000 (316-1093)	.87-.91
Type 350	200-800 (93-427)	.18-.27
Type 350, Polished	300-1800 (149-982)	.11-.35
Type 446, Polished	300-1500 (149-815)	.15-.37
Type 17-7 PH	200-600 (93-316)	.44-.51
Type 17-7 PH Polished	300-1500 (149-815)	.09-.16
Type C1020, Oxidised	600-2000 (316-1093)	.87-.91
Type PH-15-7 MO	300-1200 (149-649)	.07-.19

	Temp F° (C°)	Emissivity
Stellite, Polished		
	68 (20)	0.18
Tantalum, Unoxidised		
	1340 (727)	0.14
	2000 (1093)	0.19
	3600 (1982)	0.26
	5306 (2930)	0.3
Tin, Unoxidised		
	77 (25)	0.04
	212 (100)	0.05
Tinned Iron, Bright		
	76 (24)	0.05
	212 (100)	0.08
Titanium		
Alloy C110M, Polished	300-1200 (149-649)	.08-.19
Oxidised at 1000°F (538°C)	200-800 (93-427)	.51-.61
Alloy Ti-95A, Oxidised at 1000°F (538°C)	200-800 (93-427)	.35-.48
Anodized onto SS	200-600 (93-316)	.96-.82
Tungsten		
Unoxidised	77 (25)	0.02
Unoxidised	212 (100)	0.03
Unoxidised	932 (500)	0.07
Unoxidised	1832 (1000)	0.15
Unoxidised	2732 (1500)	0.23
Unoxidised	3632 (2000)	0.28
Filament (Aged)	100 (38)	0.03
Filament (Aged)	1000 (538)	0.11
Filament (Aged)	5000 (2760)	0.35
Uranium Oxide		
	1880 (1027)	0.79
Zinc		
Bright, Galvanised	100 (38)	0.23
Commercial 99.1%	500 (260)	0.05
Galvanised	100 (38)	0.28
Oxidised	500-1000 (260-538)	0.11
Polished	100 (38)	0.02
Polished	500 (260)	0.03
Polished	1000 (538)	0.04
Polished	2000 (1093)	0.06