
11 Emissivity tables

This section presents a compilation of emissivity data from the infrared literature and FLIR Systems® own measurements.

11.1 References

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- 6 Paljak, Pettersson: *Thermography of Buildings*, Swedish Building Research Institute, Stockholm 1972.
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- 8 Kern: *Evaluation of infrared emission of clouds and ground as measured by weather satellites*, Defence Documentation Center, AD 617 417.
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11.2 Tables

11.2.1 Legend

T: Total spectrum, SW: 2–5 μm , LW: 8–14 μm , LLW: 6.5–20 μm

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
Aluminium	foil	27	10 μm	0.04	3
	foil	27	3 μm	0.09	3
	vacuum deposited	20	T	0.04	2

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	polished	50–100	T	0.04–0.06	1
	polished plate	100	T	0.05	4
	polished, sheet	100	T	0.05	2
	dipped in HNO ₃ , plate	100	T	0.05	4
	as received, plate	100	T	0.09	4
	as received, sheet	100	T	0.09	2
	sheet, 4 samples differently scratched	70	SW	0.05–0.08	9
	sheet, 4 samples differently scratched	70	LW	0.03–0.06	9
	rough surface	20–50	T	0.06–0.07	1
	roughened	27	10 µm	0.18	3
	roughened	27	3 µm	0.28	3
	oxidized, strongly	50–500	T	0.2–0.3	1
	weathered, heavily	17	SW	0.83–0.94	5
	cast, blast cleaned	70	SW	0.47	9
	cast, blast cleaned	70	LW	0.46	9
	anodized, light gray, dull	70	SW	0.61	9
	anodized, light gray, dull	70	LW	0.97	9
	anodized, black, dull	70	SW	0.67	9
	anodized, black, dull	70	LW	0.95	9
	anodized sheet	100	T	0.55	2
Aluminium bronze		20	T	0.60	1
Aluminium hydroxide	powder		T	0.28	1

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Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
Aluminium oxide	activated, powder		T	0.46	1
Aluminium oxide	pure, powder (alumina)		T	0.16	1
Brass	polished, highly	100	T	0.03	2
	polished	200	T	0.03	1
	sheet, rolled	20	T	0.06	1
	sheet, worked with emery	20	T	0.2	1
	rubbed with 80-grit emery	20	T	0.20	2
	dull, tarnished	20–350	T	0.22	1
	oxidized	70	SW	0.04–0.09	9
	oxidized	70	LW	0.03–0.07	9
	oxidized	100	T	0.61	2
	oxidized at 600 °C	200–600	T	0.59–0.61	1
Bronze	polished	50	T	0.1	1
	porous, rough	50–150	T	0.55	1
	powder		T	0.76–0.80	1
Bronze (cont'd)	phosphor bronze	70	SW	0.08	9
	phosphor bronze	70	LW	0.06	9
Chromium	polished	500–1000	T	0.28–0.38	1
	polished	50	T	0.10	1
Copper	electrolytic, polished	–34	T	0.006	4
	electrolytic, carefully polished	80	T	0.018	1
	pure, carefully prepared surface	22	T	0.008	4

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	polished, mechanical	22	T	0.015	4
	polished	50–100	T	0.02	1
	polished	100	T	0.03	2
	polished, commercial	27	T	0.03	4
	commercial, bur-nished	20	T	0.07	1
	scraped	27	T	0.07	4
	molten	1100–1300	T	0.13–0.15	1
	oxidized	50	T	0.6–0.7	1
	oxidized, heavily	20	T	0.78	2
	oxidized, black	27	T	0.78	4
	oxidized to blackness		T	0.88	1
Copper oxide	red, powder		T	0.70	1
Copper dioxide	powder		T	0.84	1
Gold	polished	130	T	0.018	1
	polished, carefully	200–600	T	0.02–0.03	1
	polished, highly	100	T	0.02	2
Iron, cast	polished	38	T	0.21	4
	polished	40	T	0.21	2
	polished	200	T	0.21	1
	liquid	1300	T	0.28	1
	machined	800–1000	T	0.60–0.70	1
	oxidized	38	T	0.63	4
	oxidized	100	T	0.64	2
	oxidized at 600°C	200–600	T	0.64–0.78	1

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Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	oxidized	260	T	0.66	4
	oxidized	538	T	0.76	4
	casting	50	T	0.81	1
	unworked	900–1100	T	0.87–0.95	1
	ingots	1000	T	0.95	1
Iron and steel	electrolytic	22	T	0.05	4
	electrolytic	100	T	0.05	4
	electrolytic, carefully polished	175–225	T	0.05–0.06	1
	electrolytic	260	T	0.07	4
	polished	400–1000	T	0.14–0.38	1
	shiny, etched	150	T	0.16	1
	freshly worked with emery	20	T	0.24	1
	wrought, carefully polished	40–250	T	0.28	1
	covered with red rust	20	T	0.61–0.85	1
	heavily rusted sheet	20	T	0.69	2
	rusted red, sheet	22	T	0.69	4
	rusted, heavily	17	SW	0.96	5
	oxidized	100	T	0.74	4
	oxidized	100	T	0.74	1
oxidized	125–525	T	0.78–0.82	1	
oxidized	1227	T	0.89	4	
hot rolled	20	T	0.77	1	
hot rolled	130	T	0.60	1	

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	cold rolled	70	SW	0.20	9
	cold rolled	70	LW	0.09	9
	oxidized strongly	50	T	0.88	1
	oxidized strongly	500	T	0.98	1
	rough, plane surface	50	T	0.95–0.98	1
	polished sheet	750–1050	T	0.52–0.56	1
	ground sheet	950–1100	T	0.55–0.61	1
	rusty, red	20	T	0.69	1
	oxidized	200	T	0.79	2
	oxidized	200–600	T	0.80	1
	shiny oxide layer, sheet,	20	T	0.82	1
	polished	100	T	0.07	2
	rolled, freshly	20	T	0.24	1
	rolled sheet	50	T	0.56	1
Iron tinned	sheet	24	T	0.064	4
Iron galvanized	sheet	92	T	0.07	4
	sheet, burnished	30	T	0.23	1
	sheet, oxidized	20	T	0.28	1
	heavily oxidized	70	SW	0.64	9
	heavily oxidized	70	LW	0.85	9
Lead	unoxidized, polished	100	T	0.05	4
	shiny	250	T	0.08	1
	oxidized, gray	20	T	0.28	1
	oxidized, gray	22	T	0.28	4

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Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	oxidized at 200 °C	200	T	0.63	1
Lead red		100	T	0.93	4
Lead red, powder		100	T	0.93	1
Magnesium		22	T	0.07	4
	polished	20	T	0.07	2
		260	T	0.13	4
		538	T	0.18	4
Magnesium powder			T	0.86	1
Molybdenum		600–1000	T	0.08–0.13	1
	filament	700–2500	T	0.1–0.3	1
		1500–2200	T	0.19–0.26	1
Nichrome	rolled	700	T	0.25	1
	sandblasted	700	T	0.70	1
	wire, clean	500–1000	T	0.71–0.79	1
	wire, clean	50	T	0.65	1
	wire, oxidized	50–500	T	0.95–0.98	1
Nickel	electrolytic	22	T	0.04	4
	electrolytic	38	T	0.06	4
	electrolytic	260	T	0.07	4
	electrolytic	538	T	0.10	4
	bright matte	122	T	0.041	4
	polished	122	T	0.045	4
	commercially pure, polished	100	T	0.045	1

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	commercially pure, polished	200–400	T	0.07–0.09	1
	wire	200–1000	T	0.1–0.2	1
	electroplated on iron, polished	22	T	0.045	4
	electroplated, polished	20	T	0.05	2
	electroplated on iron, unpolished	22	T	0.11	4
	electroplated on iron, unpolished	20	T	0.11–0.40	1
	oxidized	200	T	0.37	2
	oxidized	227	T	0.37	4
	oxidized at 600 °C	200–600	T	0.37–0.48	1
	oxidized	1227	T	0.85	4
Nickel oxide		500–650	T	0.52–0.59	1
		1000–1250	T	0.75–0.86	1
Platinum		17	T	0.016	4
		22	T	0.03	4
		100	T	0.05	4
		260	T	0.06	4
		538	T	0.10	4
		1094	T	0.18	4
	pure, polished	200–600	T	0.05–0.10	1
		1000–1500	T	0.14–0.18	1
	wire	50–200	T	0.06–0.07	1
	wire	500–1000	T	0.10–0.16	1
	wire	1400	T	0.18	1

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Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	ribbon	900–1100	T	0.12–0.17	1
Silver	polished	100	T	0.03	2
	pure, polished	200–600	T	0.02–0.03	1
Stainless steel	type 18–8, buffed	20	T	0.16	2
	type 18–8, oxidized at 800°C	60	T	0.85	2
	sheet, polished	70	SW	0.18	9
	sheet, polished	70	LW	0.14	9
	sheet, untreated, somewhat scratched	70	SW	0.30	9
	sheet, untreated, somewhat scratched	70	LW	0.28	9
	alloy, 8 % Ni, 18 % Cr	500	T	0.35	1
	rolled	700	T	0.45	1
	sandblasted	700	T	0.70	1
Tin	burnished	20–50	T	0.04–0.06	1
	tin-plated sheet iron	100	T	0.07	2
Titanium	polished	200	T	0.15	1
	polished	500	T	0.20	1
	polished	1000	T	0.36	1
	oxidized at 540 °C	200	T	0.40	1
	oxidized at 540 °C	500	T	0.50	1
	oxidized at 540 °C	1000	T	0.60	1
Tungsten		200	T	0.05	1
		600–1000	T	0.1–0.16	1
		1500–2200	T	0.24–0.31	1

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	filament	3300	T	0.39	1
Zinc	polished	200–300	T	0.04–0.05	1
	oxidized at 400°C	400	T	0.11	1
	sheet	50	T	0.20	1
	oxidized surface	1000–1200	T	0.50–0.60	1
Asbestos	powder		T	0.40–0.60	1
	fabric		T	0.78	1
	floor tile	35	SW	0.94	7
	board	20	T	0.96	1
	slate	20	T	0.96	1
	paper	40–400	T	0.93–0.95	1
Asphalt paving		4	LLW	0.967	8
Brick	sillimanite, 33 % SiO ₂ , 64 % Al ₂ O ₃	1500	T	0.29	1
	refractory, magnesite	1000–1300	T	0.38	1
	refractory, corundum	1000	T	0.46	1
	refractory, weakly radiating	500–1000	T	0.65–0.75	1
	refractory, strongly radiating	500–1000	T	0.8–0.9	1
	fireclay	1200	T	0.59	1
	fireclay	1000	T	0.75	1
	fireclay	20	T	0.85	1
	alumina	17	SW	0.68	5
	firebrick	17	SW	0.68	5
	silica, 95 % SiO ₂	1230	T	0.66	1

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Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	Dinas silica, refractory	1000	T	0.66	1
	Dinas silica, unglazed, rough	1000	T	0.80	1
	Dinas silica, glazed, rough	1100	T	0.85	1
	common	17	SW	0.86–0.81	5
	waterproof	17	SW	0.87	5
	red, rough	20	T	0.88–0.93	1
	red, common	20	T	0.93	2
	masonry	35	SW	0.94	7
	masonry, plastered	20	T	0.94	1
Carbon	candle soot	20	T	0.95	2
	lampblack	20–400	T	0.95–0.97	1
	charcoal powder		T	0.96	1
	graphite powder		T	0.97	1
	graphite, filed surface	20	T	0.98	2
Chipboard	untreated	20	SW	0.90	6
Clay	fired	70	T	0.91	1
Cloth	black	20	T	0.98	1
Concrete		20	T	0.92	2
	dry	36	SW	0.95	7
	rough	17	SW	0.97	5
	walkway	5	LLW	0.974	8
Ebonite			T	0.89	1
Emery	coarse	80	T	0.85	1
Enamel		20	T	0.9	1

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	lacquer	20	T	0.85–0.95	1
Fibre board	hard, untreated	20	SW	0.85	6
	porous, untreated	20	SW	0.85	6
	particle board	70	SW	0.77	9
	particle board	70	LW	0.89	9
	masonite	70	SW	0.75	9
	masonite	70	LW	0.88	9
Granite	polished	20	LLW	0.849	8
	rough	21	LLW	0.879	8
	rough, 4 different samples	70	SW	0.95–0.97	9
	rough, 4 different samples	70	LW	0.77–0.87	9
Gypsum		20	T	0.8–0.9	1
Ice: Sea Water					
Lacquer	aluminium on rough surface	20	T	0.4	1
	bakelite	80	T	0.83	1
	black, matte	100	T	0.97	2
	black, dull	40–100	T	0.96–0.98	1
	black, shiny, sprayed on iron	20	T	0.87	1
	heat-resistant	100	T	0.92	1
	3 colors sprayed on aluminium	70	SW	0.50–0.53	9
	3 colors sprayed on aluminium	70	SW	9250–0.94	9
	white	100	T	0.92	2

11.2 — Tables

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	white	40–100	T	0.8–0.95	1
Leather	tanned		T	0.75–0.80	1
Lime			T	0.3–0.4	1
Mortar		17	SW	0.87	5
	dry	36	SW	0.94	7
Oil, lubricating	film on Ni base: Ni base only	20	T	0.05	2
	: 0.025 mm film	20	T	0.27	2
	: 0.050 mm film	20	T	0.46	2
	: 0.125 mm film	20	T	0.72	2
	: thick coating	20	T	0.82	2
Paint	aluminium, various ages	50–100	T	0.27–0.67	1
	cadmium yellow		T	0.28–0.33	1
	chrome green		T	0.65–0.70	1
	cobalt blue		T	0.7–0.8	1
	oil	17	SW	0.87	5
	oil based, average of 16 colors	100	T	0.94	2
	oil, various colors	100	T	0.92–0.96	1
	oil, black flat	20	SW	0.94	6
	oil, black gloss	20	SW	0.92	6
	oil, gray flat	20	SW	0.97	6
	oil, gray gloss	20	SW	0.96	6
	plastic, black	20	SW	0.95	6
	plastic, white	20	SW	0.84	6

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	8 different colors and qualities	70	SW	0.88–0.96	9
	8 different colors and qualities	70	LW	0.92–0.94	9
Paper	yellow		T	0.72	1
	red		T	0.76	1
	blue, dark		T	0.84	1
	green		T	0.85	1
	black		T	0.90	1
	coated with black lacquer		T	0.93	1
	white	20	T	0.7–0.9	1
	white bond	20	T	0.93	2
	white, 3 different glosses	70	SW	0.76–0.78	9
	white, 3 different glosses	70	LW	0.88–0.90	9
	4 different colors	70	SW	0.68–0.74	9
	4 different colors	70	LW	0.92–0.94	9
	black, dull	70	SW	0.86	9
	black, dull	70	LW	0.89	9
	black, dull		T	0.94	1
Plaster		17	SW	0.86	5
	rough coat	20	T	0.91	2
	plasterboard, untreated	20	SW	0.90	6
Plastic	PVC, plastic floor, dull, structured	70	SW	0.94	9

11.2 — Tables

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	PVC, plastic floor, dull, structured	70	LW	0.93	9
	polyurethane isolation board (frigolit)	70	SW	0.29	9
	polyurethane isolation board (frigolit)	70	LW	0.55	9
	glass fibre laminate (printed circ. board)	70	SW	0.94	9
	glass fibre laminate (printed circ. board)	70	LW	0.91	9
Porcelain	white, shiny		T	0.70–0.75	1
	glazed	20	T	0.92	1
Rubber	hard	20	T	0.95	1
	soft, gray, rough	20	T	0.95	1
Sand			T	0.60	1
		20	T	0.90	2
Sandstone	polished	19	LLW	0.909	8
	rough	19	LLW	0.935	8
Skin	human	32	T	0.98	2
Slag	boiler	0–100	T	0.97–0.93	1
	boiler	200–500	T	0.89–0.78	1
	boiler	600–1200	T	0.76–0.70	1
	boiler	1400–1800	T	0.69–0.67	1
Snow: See water					
Soil	dry	20	T	0.92	2
	saturated with water	20	T	0.95	2

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
Stucco	rough, lime	10–90	T	0.91	1
Styrofoam	insulation	37	SW	0.60	7
Tar			T	0.79–0.84	1
	paper	20	T	0.91–0.93	1
Tile	glazed	17	SW	0.94	5
Wallpaper	slight pattern, light gray	20	SW	0.85	6
	slight pattern, red	20	SW	0.90	6
Varnish	flat	20	SW	0.93	6
	on oak parquet floor	70	SW	0.90	9
	on oak parquet floor	70	LW	0.90–0.93	9
Water	snow		T	0.8	1
	snow	–10	T	0.85	2
	layer >0.1 mm thick	0–100	T	0.95–0.98	1
	distilled	20	T	0.96	2
	ice, smooth	–10	T	0.96	2
	ice, smooth	0	T	0.97	1
	ice, covered with heavy frost	0	T	0.98	1
	frost crystals	–10	T	0.98	2
Wood	ground		T	0.5–0.7	1
	planed	20	T	0.8–0.9	1
	planed oak	20	T	0.90	2
	white, damp	20	T	0.7–0.8	1
	planed oak	70	SW	0.77	9
	planed oak	70	LW	0.88	9

11.2 — Tables

Material	Specification	Temperature °C	Spectrum	Emissivity	Ref.
	pine, 4 different samples	70	SW	0.67–0.75	9
	pine, 4 different samples	70	LW	0.81–0.89	9
	plywood, smooth, dry	36	SW	0.82	7
	plywood, untreated	20	SW	0.83	6
		19	LLW	0.962	8
		17	SW	0.98	5