

Certificate of Normal Spectral Emittance

Standard Reference Materials 1420 to 1428 Oxidized Kanthal

Wavelength <i>Microns</i>	At 800 °K			At 1100 °K			At 1300 °K		
	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s
1.09	0.616	0.006	0.029	0.730	0.015	0.044	0.775	0.010	0.052
1.15	.633	.008	.026	.731	.012	.045	.775	.010	.053
1.22	.645	.007	.025	.728	.011	.046	.771	.010	.051
1.28	.653	.007	.027	.728	.010	.045	.764	.010	.049
1.36	.657	.006	.029	.725	.010	.045	.758	.009	.046
1.44	.660	.006	.029	.722	.010	.043	.753	.009	.044
1.52	.660	.005	.030	.718	.010	.039	.747	.007	.041
1.63	.659	.005	.030	.711	.010	.038	.740	.007	.039
1.74	.655	.005	.030	.702	.009	.035	.734	.007	.037
1.88	.650	.005	.028	.693	.009	.033	.725	.007	.035
2.10	.645	.005	.027	.684	.008	.032	.713	.007	.034
2.36	.638	.005	.026	.674	.008	.030	.701	.006	.033
2.60	.631	.004	.025	.664	.007	.029	.690	.007	.031
2.81	.624	.005	.023	.654	.007	.029	.678	.007	.031
3.02	.616	.004	.023	.645	.006	.028	.667	.007	.029
3.25	.610	.004	.022	.636	.006	.028	.658	.007	.029
3.45	.604	.004	.023	.628	.006	.027	.649	.007	.030
3.65	.599	.004	.022	.622	.006	.027	.642	.006	.029
3.87	.594	.004	.022	.616	.006	.026	.634	.006	.028
4.09	.587	.003	.022	.609	.005	.026	.627	.006	.028
4.30	.574	.004	.024	.599	.007	.030	.613	.008	.028
4.50	.578	.003	.021	.597	.005	.025	.614	.005	.027
4.67	.571	.003	.022	.591	.005	.026	.606	.006	.028
4.83	.568	.003	.023	.587	.005	.027	.602	.005	.028
4.99	.565	.003	.023	.584	.005	.027	.599	.005	.029
5.13	.562	.003	.023	.581	.004	.027	.595	.005	.029
5.27	.559	.003	.022	.577	.005	.026	.591	.005	.029
5.40	.555	.003	.021	.574	.004	.025	.588	.005	.028
5.54	.550	.002	.020	.569	.005	.024	.584	.005	.027
5.69	.545	.002	.020	.565	.005	.024	.579	.006	.026
5.83	.540	.002	.020	.560	.004	.023	.575	.006	.025
5.97	.535	.002	.020	.555	.004	.023	.571	.005	.026
6.10	.532	.002	.020	.551	.004	.023	.568	.005	.026
6.22	.530	.002	.020	.550	.004	.024	.566	.005	.026
6.35	.530	.002	.022	.550	.004	.025	.566	.004	.027
6.47	.530	.002	.022	.551	.004	.026	.567	.005	.028
6.58	.532	.002	.023	.555	.004	.027	.571	.005	.029
6.70	.536	.002	.024	.560	.004	.027	.576	.004	.030
6.80	.540	.002	.025	.564	.004	.028	.581	.004	.030
6.91	.547	.002	.025	.572	.004	.029	.587	.004	.031

Wavelength	At 800 °K			At 1100 °K			At 1300 °K		
<i>Microns</i>	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s
7.01	0.556	0.002	0.025	0.580	0.004	0.029	0.596	0.004	0.031
7.13	.563	.002	.025	.588	.004	.030	.605	.004	.032
7.25	.569	.002	.025	.596	.004	.030	.613	.004	.032
7.37	.577	.003	.024	.604	.004	.029	.621	.004	.032
7.49	.587	.003	.024	.612	.004	.029	.629	.004	.032
7.60	.595	.002	.023	.621	.004	.028	.637	.004	.032
7.71	.603	.002	.023	.629	.004	.028	.645	.004	.032
7.83	.609	.003	.022	.636	.004	.027	.653	.004	.032
7.94	.615	.002	.022	.642	.004	.027	.659	.004	.031
8.03	.618	.003	.022	.648	.005	.027	.665	.004	.032
8.12	.619	.002	.022	.651	.004	.027	.669	.004	.032
8.22	.620	.002	.022	.653	.004	.027	.672	.004	.032
8.32	.622	.002	.022	.655	.004	.028	.674	.004	.032
8.41	.626	.002	.023	.657	.004	.027	.677	.004	.032
8.50	.631	.002	.023	.661	.004	.028	.680	.004	.032
8.60	.636	.002	.023	.666	.004	.028	.683	.004	.032
8.70	.640	.002	.024	.670	.004	.029	.687	.004	.033
8.79	.644	.002	.024	.674	.004	.029	.692	.004	.033
8.88	.648	.002	.024	.678	.004	.029	.695	.004	.034
8.96	.653	.002	.024	.682	.004	.030	.699	.003	.034
9.05	.659	.002	.025	.687	.004	.030	.704	.004	.035
9.14	.664	.002	.025	.693	.004	.031	.709	.003	.035
9.22	.668	.002	.025	.700	.004	.031	.716	.004	.035
9.30	.671	.002	.025	.705	.004	.031	.722	.004	.035
9.38	.674	.002	.025	.710	.004	.032	.728	.004	.036
9.46	.676	.003	.026	.714	.004	.032	.733	.004	.036
9.55	.680	.002	.026	.717	.004	.032	.738	.003	.037
9.63	.684	.002	.027	.722	.004	.032	.742	.004	.037
9.71	.687	.003	.027	.727	.005	.033	.748	.003	.037
9.79	.691	.003	.027	.731	.004	.033	.753	.003	.038
9.87	.695	.003	.027	.735	.005	.033	.757	.003	.037
9.95	.698	.002	.027	.739	.005	.033	.762	.003	.037
10.03	.702	.002	.027	.744	.004	.033	.767	.003	.037
10.10	.706	.003	.027	.748	.004	.033	.771	.003	.038
10.18	.708	.002	.027	.752	.005	.033	.776	.003	.038
10.26	.709	.002	.026	.756	.005	.034	.779	.003	.038
10.34	.709	.003	.027	.758	.004	.034	.783	.004	.039
10.42	.709	.002	.026	.759	.005	.033	.785	.003	.039
10.50	.710	.002	.027	.759	.004	.034	.787	.003	.039
10.57	.711	.003	.027	.760	.004	.034	.787	.004	.039
10.64	.711	.003	.027	.760	.004	.034	.787	.003	.040
10.72	.713	.003	.027	.760	.005	.034	.787	.003	.040
10.80	.714	.003	.027	.760	.004	.034	.786	.003	.040
10.87	.715	.003	.028	.759	.004	.034	.785	.003	.040
10.94	.715	.003	.028	.758	.004	.035	.783	.003	.040
11.01	.712	.004	.028	.756	.005	.035	.781	.003	.041
11.08	.708	.003	.028	.752	.004	.035	.778	.003	.041
11.15	.703	.004	.028	.748	.005	.035	.774	.003	.042
11.22	.696	.004	.028	.742	.004	.035	.770	.003	.042
11.28	.690	.004	.028	.736	.004	.035	.764	.003	.041

Wavelength	At 800 °K			At 1100 °K			At 1300 °K		
<i>Microns</i>	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s
11.35	0.683	0.004	0.027	0.729	0.004	0.035	0.758	0.003	0.041
11.42	.676	.004	.027	.722	.004	.034	.752	.003	.041
11.49	.669	.004	.026	.716	.004	.034	.745	.003	.041
11.55	.663	.004	.025	.710	.004	.034	.740	.003	.041
11.62	.658	.005	.025	.705	.003	.033	.733	.003	.040
11.68	.654	.004	.025	.700	.003	.033	.728	.003	.040
11.74	.651	.005	.025	.695	.003	.032	.723	.003	.039
11.80	.650	.004	.024	.691	.003	.032	.718	.003	.039
11.87	.649	.005	.024	.688	.003	.032	.714	.003	.039
11.94	.648	.005	.024	.686	.003	.032	.711	.003	.038
12.00	.648	.004	.024	.684	.003	.032	.708	.003	.038
12.07	.648	.004	.024	.683	.003	.032	.705	.003	.038
12.13	.648	.004	.024	.682	.003	.031	.703	.003	.038
12.19	.648	.004	.023	.681	.003	.031	.702	.003	.038
12.26	.650	.004	.023	.680	.004	.031	.700	.003	.037
12.32	.651	.004	.023	.680	.003	.031	.699	.003	.037
12.38	.652	.004	.023	.680	.003	.031	.698	.003	.037
12.44	.653	.004	.023	.680	.003	.030	.698	.003	.037
12.50	.653	.004	.023	.681	.003	.030	.697	.003	.037
12.57	.654	.004	.022	.681	.002	.030	.697	.003	.036
12.63	.655	.004	.022	.682	.002	.029	.697	.003	.036
12.69	.656	.004	.022	.682	.002	.029	.697	.003	.035
12.75	.656	.004	.021	.682	.002	.029	.697	.002	.036
12.82	.656	.004	.021	.683	.003	.028	.697	.003	.035
12.88	.656	.004	.021	.683	.003	.028	.697	.003	.034
12.94	.656	.004	.021	.682	.002	.028	.696	.002	.034
13.00	.656	.005	.020	.682	.003	.028	.697	.002	.034
13.06	.656	.005	.019	.682	.002	.027	.696	.002	.033
13.12	.655	.005	.019	.682	.003	.027	.696	.002	.033
13.18	.655	.005	.018	.681	.003	.026	.696	.003	.032
13.24	.654	.005	.018	.680	.003	.025	.695	.002	.031
13.30	.654	.004	.018	.680	.003	.025	.694	.002	.031
13.36	.654	.004	.017	.679	.003	.024	.694	.002	.030
13.42	.652	.004	.016	.678	.003	.024	.693	.002	.030
13.48	.652	.004	.016	.678	.003	.023	.692	.003	.029
13.54	.651	.004	.016	.677	.003	.023	.692	.002	.029
13.60	.650	.005	.015	.676	.003	.022	.691	.003	.028
13.66	.650	.004	.015	.675	.003	.022	.690	.003	.028
13.72	.649	.004	.014	.675	.003	.021	.690	.002	.026
13.78	.649	.004	.014	.674	.003	.020	.689	.002	.026
13.84	.648	.004	.014	.673	.003	.020	.688	.002	.025
13.89	.647	.004	.013	.673	.003	.020	.687	.003	.024
13.95	.647	.004	.013	.672	.003	.019	.687	.003	.023
14.00	.646	.004	.014	.671	.003	.018	.686	.002	.022
14.06	.645	.004	.014	.670	.003	.018	.685	.003	.022
14.11	.645	.005	.014	.669	.003	.017	.684	.003	.021
14.17	.643	.005	.014	.669	.003	.017	.684	.003	.021
14.22	.643	.004	.015	.668	.003	.017	.683	.002	.020
14.28	.641	.005	.015	.667	.003	.017	.682	.002	.019
14.33	.640	.005	.016	.666	.003	.016	.681	.002	.018

Wavelength	At 800 °K			At 1100 °K			At 1300 °K		
<i>Microns</i>	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s	ϵ	σ_m	σ_s
14.38	0.638	0.006	0.017	0.665	0.003	0.016	0.680	0.002	0.018
14.44	.636	.007	.019	.664	.003	.016	.679	.002	.018
14.49	.634	.008	.021	.663	.003	.017	.678	.002	.017
14.55	.631	.009	.022	.662	.003	.017	.676	.002	.016
14.60	.628	.011	.024	.660	.003	.017	.675	.002	.016
14.65	.625	.011	.026	.659	.003	.018	.674	.003	.016
14.71	.623	.011	.027	.658	.003	.018	.673	.002	.016
14.76	.620	.010	.028	.656	.002	.019	.672	.002	.016
14.82	.617	.009	.029	.655	.003	.020	.671	.002	.016
14.87	.612	.007	.033	.653	.003	.021	.670	.002	.016
14.92	.609	.004	.035	.651	.003	.023	.667	.002	.018
14.98	.608	.005	.032	.648	.002	.024	.662	.002	.018
15.03	.609	.005	.029	.647	.002	.023	.662	.002	.016
15.08	.610	.004	.029	.646	.003	.023	.664	.003	.016
15.14	.609	.005	.032	.644	.003	.024	.663	.003	.019
15.20	.607	.005	.035	.642	.003	.026	.662	.003	.020

The standards of normal spectral emittance are intended for use in calibrating equipment used in various laboratories for measuring this property of materials. All of the specimens were prepared from a single sheet of metal at one time, and were subjected as nearly as possible to identical preparation treatments. Because the equipment used for the calibration of these standards was suitable only for making measurements on $\frac{1}{4}$ inch by 8 inch strips, seven such specimens were prepared from selected locations in the sheet so that the strips measured were statistically representative of the entire lot of specimens.

Three measurements were made on each of the seven samples. The value listed for normal spectral emittance (ϵ) is the arithmetic average of the 21 measured values. The computed average standard deviation (σ_m) of the three measurements on each of the seven specimens about the average value for each specimen is a measure of the precision of measurement. The standard deviation (σ_s) of the average value for each of the seven specimens about the overall average, is indicative of the variation in specimens.

Procedures used for the measurements are described in detail "Standardization of Thermal Emittance Measurements, part 4, Normal Spectral Emittance, 800-1400 °K." Technical Report No. WADC-TR-59-510, Part IV, by William N. Harrison, Joseph C. Richmond, Frederick J. Shorten and Horace M. Joseph, available from the Clearinghouse for Federal Scientific and Technical Information, 5285 Port Royal Road, Springfield, Virginia 22171, as publication AD 426846, price \$2.25.

Samples are available as $\frac{1}{2}$ inch disks, SRM No. 1420; as $\frac{7}{8}$ inch disks, SRM No. 1421; as 1 inch disks, SRM No. 1422; as $1\frac{1}{8}$ inch disks, SRM No. 1423; as $1\frac{1}{4}$ inch disks, SRM No. 1424; as 2 inch by 2 inch squares, SRM No. 1425; as 1 inch by 10 inch strips, SRM No. 1426; as $\frac{3}{4}$ inch by 10 inch strips, SRM No. 1427; and as $\frac{1}{4}$ inch by 8 inch strips, SRM No. 1428.

Instructions for Handling Emittance Standards

1. Read the instructions, including discussion.
2. Leave standards in container except when in use.
3. Wear clean surgical rubber gloves while handling specimens. Handle as little as possible, and then by edges or ends only. Never touch the flat surfaces in the areas to be viewed.
4. Do not lay standards on a desk or bench top. If possible, return to plastic holder—if not, support by edges or ends only on clean glass or stainless steel.
5. In use avoid contamination by oil, grease, dust or condensed volatile materials.

Discussion

1. INTRODUCTION. The working standards of normal spectral emittance have been carefully prepared and calibrated. However, damage to the surface or contamination can significantly change the emittance.

2. STORAGE INSTRUCTIONS. Each standard is contained in a plastic holder, which supports it by the edges or ends only. The holder containing the specimen is in turn enclosed in a metal tube or plastic box. Each standard should remain in its individual container except during actual use, and the containers should be stored in a clean, dry place at room temperature.

3. HANDLING OF SPECIMENS. Extreme precautions should be taken to prevent contamination or damage to the surface of standards during use. Handling should be kept to the absolute minimum. Wear clean surgical rubber gloves when handling specimens, in order to avoid fingerprints, and touch the ends or edges only. Never touch the flat areas to be viewed, or permit them to come in contact with a bench or desk top. If a specimen must be laid down, return it to its holder, or support it by the ends or edges only on clean glass or stainless steel. Be particularly careful to avoid contamination by oil, grease, dust or condensed volatilized materials.

4. HEATING SPECIMENS. The specimens were heated in air during calibration, and should be heated only in a clean air atmosphere at atmospheric pressure. The Kanthal and Inconel specimens have been oxidized in air, and heating in other atmospheres may significantly change the character of the oxide layer, and hence the emittance. While there is no visible oxide layer on the platinum standards, they were calibrated in air, and may change in emittance if heated in other atmospheres.