

## Certificate of Normal Spectral Emittance Standard Reference Materials 1402 to 1409 Platinum-13 Percent Rhodium Alloy

Wavelength  <i>Microns</i>	At 800 °K			At 1100 °K			At 1400 °K		
	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$
1.09	0.172	0.005	0.038	0.293	0.027	0.042	0.239	0.011	0.015
1.15	.184	.005	.042	.296	.028	.044	.233	.008	.013
1.22	.191	.004	.045	.297	.030	.046	.227	.007	.013
1.28	.197	.004	.047	.296	.032	.049	.220	.007	.012
1.36	.199	.005	.048	.294	.032	.055	.214	.006	.011
1.44	.198	.005	.048	.289	.033	.063	.207	.007	.011
1.52	.193	.005	.045	.281	.030	.071	.200	.007	.010
1.63	.184	.004	.040	.269	.029	.074	.193	.007	.010
1.74	.172	.005	.032	.250	.026	.071	.184	.006	.010
1.88	.159	.004	.024	.228	.023	.061	.177	.006	.012
2.10	.148	.004	.018	.205	.018	.046	.170	.006	.013
2.36	.138	.004	.013	.185	.014	.032	.162	.007	.014
2.60	.129	.005	.010	.169	.011	.024	.156	.006	.015
2.81	.122	.004	.008	.158	.009	.019	.151	.006	.017
3.02	.117	.005	.007	.149	.008	.016	.147	.006	.018
3.25	.112	.005	.007	.143	.007	.015	.143	.006	.019
3.45	.109	.005	.008	.138	.006	.014	.140	.005	.021
3.65	.106	.005	.008	.134	.006	.013	.138	.006	.022
3.87	.104	.004	.009	.131	.006	.013	.135	.006	.023
4.09	.102	.005	.009	.127	.006	.013	.133	.006	.024
4.30	.098	.006	.011	.124	.006	.013	.129	.006	.025
4.50	.098	.004	.010	.123	.006	.013	.129	.006	.025
4.67	.096	.005	.010	.121	.006	.013	.128	.006	.026
4.83	.095	.005	.011	.119	.006	.013	.126	.006	.027
4.99	.094	.005	.011	.117	.005	.014	.125	.006	.027
5.13	.093	.005	.011	.116	.005	.014	.124	.006	.028
5.27	.093	.005	.011	.115	.006	.014	.123	.006	.028
5.40	.092	.005	.012	.114	.006	.014	.122	.006	.029
5.54	.091	.005	.012	.113	.006	.014	.121	.006	.029
5.69	.090	.005	.012	.111	.006	.014	.120	.006	.030
5.83	.089	.005	.012	.110	.006	.014	.118	.006	.030
5.97	.088	.005	.012	.108	.006	.014	.117	.006	.030
6.10	.087	.005	.012	.107	.006	.015	.116	.006	.030
6.22	.086	.004	.013	.107	.006	.015	.115	.006	.031
6.35	.086	.005	.013	.106	.006	.015	.115	.005	.031
6.47	.085	.005	.012	.104	.006	.015	.113	.006	.031
6.58	.084	.005	.013	.104	.006	.014	.113	.005	.031
6.70	.084	.005	.013	.103	.006	.015	.112	.005	.031
6.80	.083	.005	.013	.103	.006	.015	.112	.006	.032
6.91	.083	.005	.014	.102	.006	.015	.111	.005	.032

Wavelength	At 800 °K			At 1100 °K			At 1400 °K		
<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$
7.01	0.082	0.005	0.013	0.102	0.006	0.016	0.111	0.005	0.032
7.13	.082	.005	.013	.101	.006	.016	.110	.005	.032
7.25	.081	.005	.013	.101	.006	.016	.109	.006	.032
7.37	.081	.005	.013	.100	.006	.016	.109	.006	.032
7.49	.081	.005	.014	.099	.006	.016	.109	.006	.032
7.60	.080	.005	.014	.099	.006	.016	.108	.005	.032
7.71	.080	.005	.014	.099	.006	.016	.108	.006	.033
7.83	.080	.005	.014	.099	.006	.017	.108	.005	.033
7.94	.080	.005	.014	.098	.006	.016	.107	.005	.033
8.03	.080	.005	.014	.098	.006	.016	.107	.006	.033
8.12	.081	.006	.014	.098	.006	.016	.107	.005	.033
8.22	.081	.006	.014	.099	.006	.016	.108	.006	.033
8.32	.083	.006	.014	.099	.006	.016	.108	.005	.032
8.41	.084	.005	.014	.101	.006	.016	.109	.006	.032
8.50	.085	.005	.014	.102	.006	.016	.110	.006	.032
8.60	.086	.006	.014	.103	.006	.016	.111	.006	.032
8.70	.086	.006	.013	.103	.006	.016	.111	.006	.032
8.79	.087	.006	.013	.104	.006	.016	.112	.006	.032
8.88	.087	.006	.013	.104	.006	.017	.113	.006	.032
8.96	.088	.005	.013	.104	.006	.017	.113	.006	.032
9.05	.088	.005	.013	.105	.006	.016	.114	.006	.032
9.14	.088	.006	.013	.105	.006	.016	.114	.006	.031
9.22	.088	.005	.013	.105	.005	.016	.114	.006	.032
9.30	.089	.005	.013	.105	.005	.016	.114	.006	.032
9.38	.090	.006	.013	.106	.006	.016	.114	.006	.032
9.46	.092	.006	.014	.107	.005	.016	.115	.006	.032
9.55	.093	.006	.014	.108	.006	.017	.115	.007	.032
9.63	.095	.006	.014	.110	.006	.016	.116	.006	.031
9.71	.096	.006	.014	.110	.006	.016	.117	.006	.032
9.79	.097	.006	.014	.112	.006	.015	.118	.006	.031
9.87	.098	.006	.014	.112	.006	.015	.118	.007	.032
9.95	.098	.006	.014	.113	.006	.015	.119	.006	.031
10.03	.098	.006	.014	.113	.006	.015	.119	.006	.031
10.10	.098	.006	.014	.113	.006	.015	.119	.006	.031
10.18	.097	.006	.014	.113	.006	.015	.119	.006	.031
10.26	.096	.006	.014	.112	.006	.015	.119	.006	.031
10.34	.095	.006	.013	.111	.006	.014	.118	.006	.031
10.42	.093	.006	.013	.109	.006	.014	.117	.006	.030
10.50	.091	.006	.013	.108	.006	.014	.116	.006	.030
10.57	.090	.006	.013	.106	.006	.014	.115	.005	.030
10.64	.089	.006	.013	.105	.005	.014	.114	.006	.030
10.72	.087	.006	.013	.103	.006	.013	.112	.006	.030
10.80	.085	.006	.013	.102	.006	.013	.111	.006	.030
10.87	.084	.006	.013	.100	.005	.013	.110	.006	.030
10.94	.083	.006	.013	.099	.006	.013	.109	.005	.030
11.01	.081	.006	.013	.097	.005	.013	.108	.005	.030
11.08	.080	.006	.013	.096	.006	.013	.106	.005	.030
11.15	.079	.006	.013	.095	.006	.012	.105	.005	.030
11.22	.078	.006	.012	.093	.006	.012	.104	.005	.030
11.28	.077	.006	.013	.092	.006	.012	.103	.005	.030

Wavelength	At 800 °K			At 1100 °K			At 1400 °K		
<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$
11.35	0.076	0.006	0.013	0.091	0.006	0.012	0.102	0.005	0.030
11.42	.075	.006	.013	.090	.006	.012	.101	.005	.030
11.49	.074	.006	.012	.089	.006	.011	.100	.005	.030
11.55	.074	.006	.012	.088	.006	.011	.100	.006	.030
11.62	.073	.006	.012	.088	.005	.011	.099	.005	.029
11.68	.072	.006	.012	.087	.005	.011	.098	.005	.030
11.74	.072	.006	.012	.086	.006	.011	.097	.005	.029
11.80	.072	.006	.012	.085	.005	.011	.097	.005	.029
11.87	.071	.006	.012	.085	.005	.011	.096	.005	.030
11.94	.071	.006	.012	.084	.005	.010	.096	.005	.029
12.00	.071	.006	.012	.084	.005	.010	.095	.005	.029
12.07	.070	.006	.012	.083	.005	.010	.095	.005	.029
12.13	.070	.006	.012	.083	.005	.010	.095	.005	.029
12.19	.070	.006	.012	.083	.006	.010	.095	.005	.029
12.26	.070	.006	.012	.083	.006	.010	.094	.005	.029
12.32	.070	.006	.012	.082	.006	.009	.094	.005	.029
12.38	.070	.006	.012	.082	.006	.009	.094	.005	.029
12.44	.070	.006	.012	.082	.005	.009	.094	.005	.029
12.50	.070	.006	.012	.081	.005	.009	.093	.006	.029
12.57	.069	.006	.012	.081	.005	.009	.093	.006	.029
12.63	.069	.006	.012	.081	.006	.009	.093	.006	.029
12.69	.069	.006	.012	.081	.006	.009	.093	.006	.029
12.75	.069	.006	.012	.080	.006	.008	.092	.005	.028
12.82	.069	.006	.012	.080	.006	.008	.092	.005	.028
12.88	.068	.006	.011	.079	.005	.008	.092	.005	.028
12.94	.068	.006	.011	.079	.006	.008	.091	.005	.028
13.00	.068	.006	.011	.079	.006	.008	.091	.005	.028
13.06	.067	.006	.011	.078	.006	.008	.091	.005	.028
13.12	.067	.006	.011	.078	.006	.007	.091	.005	.028
13.18	.066	.006	.011	.077	.006	.007	.090	.005	.028
13.24	.066	.006	.011	.077	.006	.007	.090	.005	.028
13.30	.066	.006	.011	.076	.006	.006	.089	.006	.028
13.36	.065	.006	.011	.076	.006	.006	.089	.006	.028
13.42	.065	.006	.011	.076	.006	.006	.089	.005	.027
13.48	.065	.006	.011	.075	.006	.006	.088	.006	.027
13.54	.064	.006	.011	.074	.006	.006	.088	.006	.027
13.60	.064	.006	.011	.074	.006	.005	.088	.005	.027
13.66	.064	.006	.011	.074	.006	.005	.088	.005	.026
13.72	.063	.006	.011	.073	.006	.005	.087	.005	.026
13.78	.063	.006	.011	.073	.006	.005	.087	.005	.026
13.84	.063	.006	.011	.072	.006	.005	.086	.005	.026
13.89	.062	.006	.011	.072	.006	.005	.086	.006	.026
13.95	.062	.006	.010	.071	.006	.005	.086	.006	.025
14.00	.062	.006	.010	.071	.006	.005	.085	.006	.025
14.06	.061	.006	.011	.071	.006	.005	.085	.006	.024
14.11	.061	.005	.010	.070	.006	.004	.084	.006	.024
14.17	.060	.005	.010	.070	.006	.005	.084	.006	.023
14.22	.060	.005	.010	.070	.006	.005	.083	.006	.022
14.28	.060	.006	.010	.069	.006	.005	.083	.006	.021
14.33	.059	.006	.009	.069	.006	.005	.082	.006	.020

Wavelength	At 800 °K			At 1100 °K			At 1400 °K		
<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$	$\epsilon$	$\sigma_m$	$\sigma_s$
14.38	0.059	0.006	0.009	0.069	0.006	0.005	0.082	0.006	0.019
14.44	.058	.005	.008	.069	.006	.005	.081	.006	.018
14.49	.057	.005	.007	.068	.006	.005	.080	.006	.016
14.55	.057	.005	.007	.068	.006	.005	.080	.006	.015
14.60	.057	.005	.007	.068	.006	.005	.079	.006	.014
14.65	.056	.006	.006	.068	.006	.005	.079	.007	.013
14.71	.056	.005	.006	.068	.006	.005	.079	.007	.012
14.76	.056	.006	.006	.068	.006	.005	.078	.007	.012
14.82	.055	.005	.006	.067	.006	.005	.077	.007	.011
14.87	.055	.005	.006	.067	.006	.005	.077	.006	.010
14.92	.054	.006	.006	.067	.006	.005	.076	.007	.009
14.98	.054	.005	.006	.067	.006	.005	.076	.007	.008
15.03	.054	.006	.006	.067	.006	.005	.076	.007	.007
15.08	.054	.006	.006	.067	.006	.005	.076	.007	.007
15.14	.053	.006	.007	.067	.006	.005	.076	.007	.007
15.20	.053	.006	.007	.067	.006	.005	.075	.007	.007

From 1 to 15 Microns, at 1600 °K

Wavelength	Wavelength			Wavelength	Wavelength		
<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$	<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$
1.0	0.239	0.004	0.025	8.5	0.103	0.004	0.023
1.5	.205	.004	.020	9.0	.108	.004	.024
2.0	.180	.003	.020	9.5	.111	.004	.024
2.5	.163	.003	.019	10.0	.118	.004	.026
3.0	.151	.003	.017	10.5	.124	.004	.024
3.5	.143	.003	.020	11.0	.127	.004	.024
4.0	.137	.003	.020	11.5	.120	.005	.025
4.5	.132	.003	.021	12.0	.112	.004	.023
5.0	.128	.003	.020	12.5	.105	.006	.026
5.5	.123	.003	.023	13.0	.101	.005	.027
6.0	.119	.003	.021	13.5	.099	.005	.026
6.5	.115	.003	.020	14.0	.098	.005	.023
7.0	.111	.003	.022	14.5	.098	.006	.031
7.5	.107	.003	.022	15.0	.100	.005	.031
8.0	.105	.004	.023				

From 14 to 35 Microns, at 1100 °K

Wavelength				Wavelength			
<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$	<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$
14.10	0.072	0.007	0.006	23.30	0.066	0.004	0.009
14.40	.067	.005	.006	23.45	.066	.003	.009
14.70	.067	.005	.006	23.55	.065	.003	.009
15.00	.065	.005	.006	23.70	.065	.003	.009
15.30	.068	.005	.006	23.80	.065	.003	.009
15.60	.068	.005	.007	23.95	.064	.003	.009
15.80	.068	.005	.008	24.10	.063	.003	.009
16.10	.068	.005	.008	24.20	.065	.003	.010
16.30	.068	.005	.009	24.30	.065	.003	.010
16.50	.067	.004	.009	24.45	.064	.003	.010
16.80	.067	.005	.009	24.60	.063	.003	.010
17.00	.067	.004	.009	24.70	.063	.003	.010
17.20	.067	.005	.009	24.80	.064	.003	.009
17.40	.068	.005	.009	24.95	.063	.003	.010
17.60	.067	.004	.010	25.10	.063	.003	.010
17.80	.067	.005	.010	25.20	.061	.003	.009
18.00	.067	.005	.009	25.30	.062	.004	.010
18.20	.067	.005	.009	25.45	.063	.003	.010
18.40	.067	.005	.009	25.55	.062	.004	.010
18.60	.067	.005	.009	25.70	.062	.004	.010
18.75	.067	.005	.010	25.80	.061	.004	.010
18.95	.067	.005	.010	25.90	.061	.003	.011
19.15	.066	.005	.010	26.05	.060	.003	.010
19.30	.067	.005	.010	26.15	.061	.003	.010
19.50	.067	.004	.009	26.30	.061	.003	.010
19.65	.066	.004	.009	26.40	.061	.004	.010
19.80	.066	.004	.009	26.50	.060	.004	.010
20.00	.066	.005	.009	26.60	.060	.003	.010
20.10	.066	.005	.010	26.70	.060	.003	.010
20.30	.066	.004	.010	26.80	.061	.004	.011
20.45	.066	.004	.009	26.95	.060	.004	.010
20.60	.066	.004	.009	27.05	.060	.003	.010
20.80	.066	.005	.010	27.20	.059	.003	.010
20.90	.066	.004	.010	27.30	.060	.003	.010
21.00	.065	.005	.010	27.40	.059	.004	.010
21.15	.066	.005	.010	27.50	.059	.004	.010
21.30	.066	.005	.009	27.60	.059	.004	.011
21.45	.066	.005	.008	27.75	.058	.004	.011
21.60	.066	.004	.008	27.90	.058	.004	.011
21.75	.067	.004	.009	28.00	.058	.004	.011
21.90	.066	.005	.008	28.10	.057	.004	.011
22.05	.065	.004	.008	28.20	.057	.004	.010
22.20	.065	.004	.008	28.30	.057	.003	.010
22.35	.066	.005	.009	28.40	.057	.004	.010
22.45	.066	.005	.008	28.50	.057	.004	.011
22.65	.066	.005	.008	28.60	.057	.004	.010
22.85	.065	.005	.008	28.70	.057	.004	.010
22.90	.065	.005	.008	28.80	.057	.004	.010
23.05	.066	.004	.009	28.95	.056	.004	.010
23.20	.066	.004	.009	29.05	.056	.004	.010

From 14 to 35 Microns, at 1100 °K (Continued)

Wavelength				Wavelength			
<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$	<i>Microns</i>	$\epsilon$	$\sigma_m$	$\sigma_s$
29.15	0.056	0.004	0.011	33.30	0.050	0.006	0.011
29.25	.056	.003	.011	33.40	.050	.006	.010
29.35	.055	.003	.011	33.50	.049	.006	.011
29.50	.055	.004	.011	33.60	.049	.005	.011
29.60	.054	.004	.011	33.70	.048	.005	.011
29.70	.053	.004	.012	33.80	.047	.005	.011
29.80	.053	.004	.011	33.90	.047	.005	.011
29.90	.054	.004	.010	34.00	.047	.005	.011
30.00	.053	.004	.010	34.10	.047	.005	.011
30.10	.053	.004	.010	34.20	.046	.005	.011
30.20	.052	.004	.010	34.30	.046	.005	.010
30.35	.052	.004	.010	34.40	.045	.005	.011
30.45	.052	.004	.010	34.50	.046	.005	.011
30.55	.052	.004	.010	34.60	.046	.006	.012
30.65	.052	.004	.010	34.70	.046	.006	.012
30.75	.052	.004	.011	34.85	.046	.006	.011
30.85	.053	.004	.010	34.95	.046	.006	.011
30.95	.052	.004	.010	35.05	.045	.006	.010
31.05	.052	.004	.011	35.15	.045	.006	.011
31.15	.052	.004	.011	35.25	.044	.006	.010
31.25	.052	.004	.011	35.35	.043	.006	.011
31.35	.052	.004	.011	35.45	.043	.006	.010
31.45	.051	.004	.011	35.55	.043	.007	.011
31.60	.051	.004	.011	35.65	.043	.008	.011
31.70	.051	.004	.010	35.75	.044	.008	.011
31.80	.051	.004	.010	35.80	.044	.007	.010
31.90	.050	.004	.010	35.95	.044	.007	.009
32.00	.050	.004	.011	36.05	.044	.007	.011
32.10	.050	.004	.011	36.15	.043	.007	.012
32.20	.050	.003	.011	36.25	.044	.007	.012
32.30	.050	.004	.011	36.35	.044	.008	.011
32.40	.050	.004	.011	36.45	.042	.007	.011
32.50	.050	.005	.011	36.55	.042	.007	.011
32.60	.050	.006	.011	36.65	.043	.006	.013
32.70	.049	.005	.012				
32.80	.049	.006	.012				
32.90	.049	.006	.011				
33.00	.049	.007	.012				
33.10	.049	.007	.012				
33.20	.049	.007	.012				

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 from 1 to 15  $\mu$  at 800, 1100, and 1400 °K was suitable only for making measurements on 1/4 in. by 8 in. strips, seven such specimens were prepared from selected locations in the sheet so that the strips measured were statistically representative of the en-

tire lot of specimens. Three measurements were made on each of the seven samples. The value listed for normal spectral emittance ( $\epsilon$ ) is the arithmetic average of the 21 measured values. The computed average standard deviation ( $\sigma_m$ ) 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 ( $\sigma_s$ ) of the average value for each of the seven specimens about the overall average, is indicative of the variation in specimens.

For the measurements from 1 to 15  $\mu$  at 1600 °K, and for the measurements from 14 to 35  $\mu$  at 1100 °K, only three specimens were measured. Values for  $\epsilon$ ,  $\sigma_m$ , and  $\sigma_s$  were derived, as outlined above, from the three measurements made on each of the three specimens.

Procedures used for the measurements are described in detail in "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.

Because the equipment used for measuring the strip samples has an upper limit of safe operation of 1400 °K, data reported for 1600 °K were measured by the rotating cylinder procedure described in NBS Monograph "A Rotating Cylinder Method for Measuring Normal Spectral Emittance of Ceramic Oxide Specimens from 1200 to 1600 °K" by Howard E. Clark and Dwight G. Moore.

Samples are available as  $\frac{1}{2}$  in. disks, SRM No. 1402; as  $\frac{7}{8}$  in. disks, SRM No. 1403; as 1 in. disks, SRM No. 1404; as  $1\frac{1}{8}$  in. disks, SRM No. 1405; as  $1\frac{1}{4}$  in. disks, SRM No. 1406; as 2 in. by 2 in. squares, SRM No. 1407; as 1 in. by 10 in. strips, SRM No. 1408; and as  $\frac{3}{4}$  in. by 10 in. strips, SRM No. 1409.

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W. Wayne Meinke, Chief  
Office of Standard Reference Materials