



National Institute of Standards & Technology

Certificate

Standard Reference Material® 1749

Gold versus Platinum Thermocouple
Certified Thermometer for the Range 0 °C to 1000 °C
on the International Temperature Scale of 1990

Serial No.

This Standard Reference Material (SRM) is intended for use as a highly accurate secondary reference thermometer in the range from 0 °C to 1000 °C [1]. SRM 1749 consists of a specially constructed gold versus platinum (Au/Pt) thermocouple, individually calibrated on the International Temperature Scale of 1990 (ITS-90) [2]. This SRM has an overall length of 1.9 m, as measured from the tip of the silica-glass sheath (7.0 mm outer diameter, 71 cm long) to the tip of the stainless steel sheath of the reference-junction probe (6.3 mm outer diameter, 28 cm long). The copper leads from the reference-junction probe of the SRM are 2.1 m long. In use, the reference-junction probe of the SRM is inserted into a properly prepared ice point bath and the copper leads are connected to a high-accuracy voltmeter. The relation of voltage readings of the SRM to the temperature of the measuring junction is provided in this certificate in tabular and mathematical forms.

Certified Values and Confidence Limits: The electromotive force (emf) of the SRM was measured in fixed-point cells at 961.78 °C (silver point), 660.323 °C (aluminum point), 419.527 °C (zinc point), 231.928 °C (tin point), and 156.5985 °C (indium point), and in an ice bath at 0.000 °C, with the reference junctions at the ice point. The measured values of emf are given in Table 1. The emf values computed from the reference function [3] were subtracted from the measured values, and the resulting emf deviations were modeled by a quadratic function of temperature up to 1000 °C. Coefficients of the quadratic function were determined by the method of least squares, and addition of these coefficients to those of the reference function gave the coefficients of the calibration function for this SRM. Table 2 gives corresponding values of the emf of the SRM in millivolts and the temperature of its measuring junction in degrees Celsius when the reference junctions are at 0 °C. Table 3 gives the coefficients of the equation that was used to compute the emf values given in Table 2. Figure 1 shows the deviations of the measured values of emf from values obtained from the Au/Pt reference function. The thermoelectric inhomogeneity of the thermocouple was assessed by measuring its immersion characteristics in the silver and aluminum fixed-point cells [1].

The uncertainty of an emf value can be expressed as an expanded uncertainty, $U = k u_c$, with U determined from a combined standard uncertainty, u_c and a coverage factor, $k = 2$. The expanded uncertainties of the emf values given in Tables 1 and 2 are estimated not to exceed the equivalent of 7 m°C in the range 0 °C to 660 °C, the equivalent of 8 m°C in the range 660 °C to 962 °C, and the equivalent of 14 m°C in the range 962 °C to 1000 °C. These uncertainties include a contribution for the inhomogeneity of the thermocouple.

Construction and calibration of the Au/Pt thermocouple were performed by G.W. Burns and D.C. Ripple of the NIST Process Measurements Division.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the NIST Standard Reference Materials Program by J.W.L. Thomas and J.C. Colbert.

Gaithersburg, MD 20899
Certificate Issue Date: 18 March 1998

Thomas E. Gills, Chief
Standard Reference Materials Program

Expiration of Certification: The certification of this SRM is valid within the measurement uncertainties specified, for at least 1000 h of use at temperatures up to 963 °C, provided the SRM is used in accordance with the Notice and Warning to Users section of this certificate. No long term drift has been observed with several Au/Pt thermocouples that have been studied for periods of time exceeding 1000 h and that have been maintained in accordance with the procedures described in the Instructions for Use. Recertification may be arranged by contacting D.C. Ripple of the NIST Process Measurements Division by phone (301) 975-4801, fax (301) 548-0206, or e-mail dean.ripple@nist.gov. Certification is invalid if the SRM is damaged, contaminated, or modified.

Maintenance of SRM Certification: NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification, NIST will notify the purchaser. Return of the attached registration card will facilitate notification.

Source of Material: The gold wire (Bar 100-431) and the platinum wire (Bar 240-183) for the SRM have a reported purity as a mass fraction of 99.999+ % and were obtained from the Sigmund Cohn Corporation, Mount Vernon, NY. The alumina insulator tubes have a reported purity of 99.8+ % and were obtained from Vesuvius McDanel, Beaver Falls, PA.

NOTICE AND WARNING TO USERS

Storage: SRM 1749 is a thermocouple thermometer, packaged in foam in a wooden case. When not in use, the thermocouple should be stored in its original case to avoid damage.

Handling: This SRM is supplied with a protective silica-glass sheath. If this sheath is damaged, the thermocouple may be subject to contamination with resulting degradations in performance. The thermocouple may be used with or without the protective sheath. However, use of the thermocouple without the protective sheath should be attempted only by trained personnel. Extreme care must be taken to ensure that the expansion coil is not damaged and that the thermocouple is used only in oxidizing environments free of vapors from metals or metal oxides.

Instructions for Use: To use, the copper leads of the SRM should be connected to a high-accuracy voltmeter. To achieve the highest level of accuracy with this SRM, the user should use a calibrated voltmeter with a resolution of 0.01 μ V or better, and care must be taken to measure and correct for stray thermal emfs in the measurement circuit.

The reference-junction probe is designed to be inserted through the lid of a standard Dewar flask filled with crushed ice, with distilled water filling the voids between the ice particles. The tip of the reference-junction probe should be immersed 20 cm into the ice-water mixture. The ice should be made from distilled water, the flask should be at least 28 cm deep, and the ice should be lightly packed to the full depth of the flask. After inserting the probe into the ice bath, allow 10 min to 15 min for the probe to attain thermal equilibrium. The reference-junction probe should be kept clean of contaminants that could cause a depression of the melting point of the ice. Washing the probe in distilled water or wiping the probe with a tissue saturated in distilled water will aid in the removal of salts and other impurities.

The silica-glass sheath will devitrify and eventually crack if it is used at temperatures above 500 °C after being contaminated with oils or salts from handling of the sheath with bare hands or other sources. This problem may be avoided by wiping the sheath with a tissue saturated in ethanol or methanol prior to use at elevated temperatures.

The thermocouple should not be used at temperatures exceeding 1000 °C. Higher temperatures may cause slippage of grain boundaries in the gold wire. During use or annealing, not more than 65 cm of the portion of the SRM sheathed in silica glass, as measured from the tip of the sheath, should be heated.

Au/Pt thermocouples are fairly rugged devices, capable of withstanding repeated thermal cycling and small mechanical shocks. However, two maintenance procedures are necessary to ensure that there is no degradation in accuracy.

First, the platinum expansion coil at the measuring junction should be inspected periodically. The silica-glass sheath does not have a matte finish in the vicinity of the measuring junction. This allows the user to inspect the coil without removal of the protective sheath. At room temperature, both thermoelements should extend from the alumina tube by the same amount as when the SRM was first received from NIST. If the protrusion of one of the thermoelements increases by more than about 1 mm after a single period of heating to elevated temperatures and then cooling to room temperature, the thermoelement may have become slightly lodged in the bore of the alumina tube and may have been mechanically strained.

Second, Au/Pt thermocouples should be given a periodic maintenance anneal if they are removed quickly from high temperature environments or if they are used in different thermal environments. The procedure is to anneal the portion of the SRM sheathed in silica glass in a tube furnace at the fullest possible immersion (not more than 65 cm) into the furnace at 1000 °C for 30 min, cool slowly in the furnace to 450 °C, and maintain at 450 °C overnight. The anneal at 1000 °C is optional and only necessary to alleviate strains introduced if the thermocouple has been rapidly cooled.

PREPARATION AND CERTIFICATION MEASUREMENTS

Method of Preparation: After being annealed in air, the Au and Pt thermoelements were inserted into a high purity alumina tube. The measuring junction of the Au/Pt thermocouple was formed by joining the thermoelements at one end with a small coil formed from Pt wire 0.12 mm in diameter. The thermocouple and alumina insulator were mounted inside a protective silica-glass sheath, with the alumina insulator secured in the sheath with a compression fitting. To minimize heat loss by piping of thermal radiation, the silica-glass sheath was given a matte finish. The thermoelements extending from the insulator were covered with coated fiberglass sleeving, and a crimp-type clamp was installed that compresses the sleeving against the thermoelements to anchor them near the end of the alumina insulator. At the end of the thermoelements opposite from the measuring junction, matched copper leads were attached to form the reference junctions. The reference junctions are contained within a stainless steel sheath. To remove residual stresses introduced in the assembly process, the portion of the SRM sheathed in silica glass was given a final furnace anneal.

Measurement Techniques: The emf measurements were made using a calibrated digital multimeter connected to a scanner. Stray thermal emfs from the scanner and voltmeter were carefully measured, and the data were appropriately corrected. Data acquisition was computer controlled. The freezing-point cells used for the calibration of this SRM were all constructed at NIST and intercompared with the reference cells maintained in the NIST Platinum Resistance Thermometer Calibration Laboratory.

COMPATABILITY WITH NIST STANDARD REFERENCE DATABASE 60

The equation in Table 3 is compatible with NIST Standard Reference Database 60, NIST ITS-90 Thermocouple Database. For further information, contact D.C. Ripple of the NIST Process Measurements Division by phone (301) 975-4801, fax (301) 548-0206, or e-mail dean.ripple@nist.gov.

REFERENCES

- [1] Burns, G.W. and Ripple, D., "Standard Reference Material 1749: Gold vs. Platinum Thermocouple," NIST Special Publication 260-134, U.S. Government Printing Office, Washington, DC, (1998).
- [2] Preston-Thomas, H., "The International Temperature Scale of 1990," *Metrologia*, **27**, pp. 3-10, (1990) and *Metrologia*, **27**, p. 107, (1990).
- [3] Burns, G.W., Strouse, G.F., Liu, B.M., and Mangum, B.W., "Gold versus Platinum Thermocouples: Performance Data and an ITS-90 Based Reference Function," in *Temperature: Its Measurement and Control in Science and Industry*, American Institute of Physics, New York, NY, p. 531, (1992).

It is the responsibility of users of this SRM to assure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: Phone (301) 975-6776 (select "Certificates"), Fax (301) 926-4751, e-mail srminfo@nist.gov, or via the Internet <http://ts.nist.gov/srm>.

TABLE 1. Values of EMF Determined at Fixed Points for the Au/Pt Thermocouple with the Reference Junctions at 0 °C

Temperature (°C, ITS-90)		EMF (mV)
961.78	(silver point)	16.12055
660.323	(aluminum point)	9.32034
419.527	(zinc point)	4.94553
231.928	(tin point)	2.23607
156.5985	(indium point)	1.35081
0.000	(ice point)	-0.00005

TABLE 2. Values of EMF in Millivolts versus Temperature in Degrees Celsius (ITS-90)
for the Au/Pt Thermocouple with Reference Junctions at 0 °C

°C	0	1	2	3	4	5	6	7	8	9
	EMF (mV)									
0	-0.0001	0.0060	0.0121	0.0182	0.0244	0.0306	0.0369	0.0431	0.0495	0.0558
10	0.0622	0.0687	0.0751	0.0816	0.0882	0.0948	0.1014	0.1080	0.1147	0.1215
20	0.1282	0.1350	0.1419	0.1488	0.1557	0.1626	0.1696	0.1766	0.1837	0.1908
30	0.1979	0.2050	0.2122	0.2195	0.2267	0.2340	0.2413	0.2487	0.2561	0.2635
40	0.2710	0.2785	0.2861	0.2936	0.3012	0.3089	0.3165	0.3242	0.3320	0.3398
50	0.3476	0.3554	0.3633	0.3712	0.3791	0.3871	0.3951	0.4031	0.4112	0.4193
60	0.4274	0.4356	0.4437	0.4520	0.4602	0.4685	0.4768	0.4852	0.4936	0.5020
70	0.5104	0.5189	0.5274	0.5359	0.5445	0.5531	0.5617	0.5704	0.5791	0.5878
80	0.5966	0.6053	0.6142	0.6230	0.6319	0.6408	0.6497	0.6587	0.6676	0.6767
90	0.6857	0.6948	0.7039	0.7130	0.7222	0.7314	0.7406	0.7499	0.7592	0.7685
100	0.7778	0.7872	0.7966	0.8060	0.8154	0.8249	0.8344	0.8440	0.8535	0.8631
110	0.8728	0.8824	0.8921	0.9018	0.9115	0.9213	0.9311	0.9409	0.9507	0.9606
120	0.9705	0.9804	0.9904	1.0003	1.0103	1.0204	1.0304	1.0405	1.0506	1.0608
130	1.0709	1.0811	1.0913	1.1016	1.1119	1.1222	1.1325	1.1428	1.1532	1.1636
140	1.1740	1.1845	1.1950	1.2055	1.2160	1.2266	1.2371	1.2477	1.2584	1.2690
150	1.2797	1.2904	1.3012	1.3119	1.3227	1.3335	1.3443	1.3552	1.3661	1.3770
160	1.3879	1.3989	1.4099	1.4209	1.4319	1.4430	1.4540	1.4651	1.4763	1.4874
170	1.4986	1.5098	1.5210	1.5323	1.5436	1.5549	1.5662	1.5775	1.5889	1.6003
180	1.6117	1.6231	1.6346	1.6461	1.6576	1.6691	1.6807	1.6923	1.7039	1.7155
190	1.7272	1.7388	1.7505	1.7623	1.7740	1.7858	1.7976	1.8094	1.8212	1.8331
200	1.8450	1.8569	1.8688	1.8807	1.8927	1.9047	1.9167	1.9288	1.9408	1.9529
210	1.9650	1.9772	1.9893	2.0015	2.0137	2.0259	2.0381	2.0504	2.0627	2.0750
220	2.0873	2.0997	2.1120	2.1244	2.1369	2.1493	2.1618	2.1742	2.1867	2.1993
230	2.2118	2.2244	2.2370	2.2496	2.2622	2.2749	2.2875	2.3002	2.3130	2.3257
240	2.3385	2.3512	2.3640	2.3769	2.3897	2.4026	2.4155	2.4284	2.4413	2.4542
250	2.4672	2.4802	2.4932	2.5063	2.5193	2.5324	2.5455	2.5586	2.5717	2.5849
260	2.5981	2.6113	2.6245	2.6377	2.6510	2.6643	2.6776	2.6909	2.7042	2.7176
270	2.7310	2.7444	2.7578	2.7712	2.7847	2.7982	2.8117	2.8252	2.8387	2.8523
280	2.8659	2.8795	2.8931	2.9067	2.9204	2.9341	2.9478	2.9615	2.9752	2.9890
290	3.0028	3.0166	3.0304	3.0442	3.0581	3.0720	3.0859	3.0998	3.1137	3.1277
300	3.1416	3.1556	3.1696	3.1837	3.1977	3.2118	3.2259	3.2400	3.2541	3.2683
310	3.2824	3.2966	3.3108	3.3251	3.3393	3.3536	3.3679	3.3822	3.3965	3.4108
320	3.4252	3.4395	3.4539	3.4684	3.4828	3.4972	3.5117	3.5262	3.5407	3.5552
330	3.5698	3.5843	3.5989	3.6135	3.6281	3.6428	3.6574	3.6721	3.6868	3.7015
340	3.7163	3.7310	3.7458	3.7606	3.7754	3.7902	3.8050	3.8199	3.8348	3.8497
350	3.8646	3.8795	3.8945	3.9094	3.9244	3.9394	3.9545	3.9695	3.9846	3.9996
360	4.0147	4.0298	4.0450	4.0601	4.0753	4.0905	4.1057	4.1209	4.1362	4.1514
370	4.1667	4.1820	4.1973	4.2126	4.2280	4.2434	4.2587	4.2741	4.2896	4.3050
380	4.3205	4.3359	4.3514	4.3669	4.3825	4.3980	4.4136	4.4291	4.4447	4.4604
390	4.4760	4.4916	4.5073	4.5230	4.5387	4.5544	4.5702	4.5859	4.6017	4.6175
400	4.6333	4.6491	4.6650	4.6808	4.6967	4.7126	4.7285	4.7445	4.7604	4.7764

TABLE 2 (Continued). Values of EMF in Millivolts versus Temperature in Degrees Celsius (ITS-90) for the Au/Pt Thermocouple with Reference Junctions at 0 °C

°C	0	1	2	3	4	5	6	7	8	9
	EMF (mV)									
400	4.6333	4.6491	4.6650	4.6808	4.6967	4.7126	4.7285	4.7445	4.7604	4.7764
410	4.7924	4.8084	4.8244	4.8404	4.8565	4.8725	4.8886	4.9047	4.9208	4.9370
420	4.9531	4.9693	4.9855	5.0017	5.0179	5.0342	5.0504	5.0667	5.0830	5.0993
430	5.1157	5.1320	5.1484	5.1648	5.1811	5.1976	5.2140	5.2304	5.2469	5.2634
440	5.2799	5.2964	5.3129	5.3295	5.3461	5.3627	5.3793	5.3959	5.4125	5.4292
450	5.4458	5.4625	5.4792	5.4959	5.5127	5.5294	5.5462	5.5630	5.5798	5.5966
460	5.6135	5.6303	5.6472	5.6641	5.6810	5.6979	5.7149	5.7318	5.7488	5.7658
470	5.7828	5.7998	5.8169	5.8339	5.8510	5.8681	5.8852	5.9023	5.9195	5.9366
480	5.9538	5.9710	5.9882	6.0054	6.0227	6.0399	6.0572	6.0745	6.0918	6.1091
490	6.1265	6.1438	6.1612	6.1786	6.1960	6.2134	6.2309	6.2484	6.2658	6.2833
500	6.3008	6.3184	6.3359	6.3535	6.3710	6.3886	6.4062	6.4239	6.4415	6.4592
510	6.4768	6.4945	6.5122	6.5300	6.5477	6.5655	6.5832	6.6010	6.6188	6.6367
520	6.6545	6.6724	6.6902	6.7081	6.7260	6.7440	6.7619	6.7799	6.7978	6.8158
530	6.8338	6.8518	6.8699	6.8879	6.9060	6.9241	6.9422	6.9603	6.9785	6.9966
540	7.0148	7.0330	7.0512	7.0694	7.0876	7.1059	7.1242	7.1424	7.1607	7.1791
550	7.1974	7.2157	7.2341	7.2525	7.2709	7.2893	7.3078	7.3262	7.3447	7.3631
560	7.3816	7.4002	7.4187	7.4372	7.4558	7.4744	7.4930	7.5116	7.5302	7.5489
570	7.5675	7.5862	7.6049	7.6236	7.6423	7.6611	7.6799	7.6986	7.7174	7.7362
580	7.7551	7.7739	7.7928	7.8116	7.8305	7.8494	7.8684	7.8873	7.9063	7.9252
590	7.9442	7.9632	7.9822	8.0013	8.0203	8.0394	8.0585	8.0776	8.0967	8.1158
600	8.1350	8.1542	8.1733	8.1926	8.2118	8.2310	8.2502	8.2695	8.2888	8.3081
610	8.3274	8.3467	8.3661	8.3855	8.4048	8.4242	8.4436	8.4631	8.4825	8.5020
620	8.5215	8.5409	8.5605	8.5800	8.5995	8.6191	8.6387	8.6582	8.6779	8.6975
630	8.7171	8.7368	8.7564	8.7761	8.7958	8.8156	8.8353	8.8551	8.8748	8.8946
640	8.9144	8.9342	8.9541	8.9739	8.9938	9.0137	9.0336	9.0535	9.0734	9.0934
650	9.1133	9.1333	9.1533	9.1733	9.1933	9.2134	9.2334	9.2535	9.2736	9.2937
660	9.3139	9.3340	9.3542	9.3743	9.3945	9.4147	9.4350	9.4552	9.4754	9.4957
670	9.5160	9.5363	9.5566	9.5770	9.5973	9.6177	9.6381	9.6585	9.6789	9.6993
680	9.7198	9.7402	9.7607	9.7812	9.8017	9.8223	9.8428	9.8634	9.8840	9.9046
690	9.9252	9.9458	9.9664	9.9871	10.0078	10.0285	10.0492	10.0699	10.0906	10.1114
700	10.1322	10.1530	10.1738	10.1946	10.2154	10.2363	10.2572	10.2780	10.2989	10.3199
710	10.3408	10.3618	10.3827	10.4037	10.4247	10.4457	10.4668	10.4878	10.5089	10.5299
720	10.5510	10.5722	10.5933	10.6144	10.6356	10.6568	10.6780	10.6992	10.7204	10.7416
730	10.7629	10.7842	10.8055	10.8268	10.8481	10.8694	10.8908	10.9121	10.9335	10.9549
740	10.9764	10.9978	11.0192	11.0407	11.0622	11.0837	11.1052	11.1267	11.1483	11.1698
750	11.1914	11.2130	11.2346	11.2563	11.2779	11.2996	11.3212	11.3429	11.3646	11.3864
760	11.4081	11.4299	11.4516	11.4734	11.4952	11.5170	11.5389	11.5607	11.5826	11.6045
770	11.6264	11.6483	11.6702	11.6922	11.7142	11.7361	11.7581	11.7801	11.8022	11.8242
780	11.8463	11.8684	11.8904	11.9126	11.9347	11.9568	11.9790	12.0012	12.0233	12.0456
790	12.0678	12.0900	12.1123	12.1345	12.1568	12.1791	12.2014	12.2238	12.2461	12.2685
800	12.2909	12.3133	12.3357	12.3581	12.3806	12.4030	12.4255	12.4480	12.4705	12.4930

TABLE 2 (Continued). Values of EMF in Millivolts versus Temperature in Degrees Celsius (ITS-90)
for the Au/Pt Thermocouple with Reference Junctions at 0 °C

°C	0	1	2	3	4	5	6	7	8	9
	EMF (mV)									
800	12.2909	12.3133	12.3357	12.3581	12.3806	12.4030	12.4255	12.4480	12.4705	12.4930
810	12.5156	12.5381	12.5607	12.5833	12.6059	12.6285	12.6511	12.6738	12.6965	12.7191
820	12.7418	12.7646	12.7873	12.8100	12.8328	12.8556	12.8784	12.9012	12.9240	12.9469
830	12.9697	12.9926	13.0155	13.0384	13.0613	13.0843	13.1072	13.1302	13.1532	13.1762
840	13.1992	13.2222	13.2453	13.2684	13.2914	13.3145	13.3377	13.3608	13.3839	13.4071
850	13.4303	13.4535	13.4767	13.4999	13.5231	13.5464	13.5697	13.5930	13.6163	13.6396
860	13.6629	13.6863	13.7096	13.7330	13.7564	13.7798	13.8033	13.8267	13.8502	13.8737
870	13.8972	13.9207	13.9442	13.9677	13.9913	14.0149	14.0385	14.0621	14.0857	14.1093
880	14.1330	14.1566	14.1803	14.2040	14.2277	14.2515	14.2752	14.2990	14.3228	14.3466
890	14.3704	14.3942	14.4180	14.4419	14.4658	14.4897	14.5136	14.5375	14.5614	14.5854
900	14.6093	14.6333	14.6573	14.6813	14.7054	14.7294	14.7535	14.7776	14.8017	14.8258
910	14.8499	14.8740	14.8982	14.9224	14.9465	14.9708	14.9950	15.0192	15.0435	15.0677
920	15.0920	15.1163	15.1406	15.1650	15.1893	15.2137	15.2380	15.2624	15.2868	15.3113
930	15.3357	15.3602	15.3846	15.4091	15.4336	15.4581	15.4827	15.5072	15.5318	15.5564
940	15.5810	15.6056	15.6302	15.6548	15.6795	15.7042	15.7289	15.7536	15.7783	15.8030
950	15.8278	15.8526	15.8773	15.9021	15.9270	15.9518	15.9766	16.0015	16.0264	16.0513
960	16.0762	16.1011	16.1260	16.1510	16.1760	16.2010	16.2260	16.2510	16.2760	16.3011
970	16.3261	16.3512	16.3763	16.4014	16.4266	16.4517	16.4769	16.5020	16.5272	16.5524
980	16.5777	16.6029	16.6282	16.6534	16.6787	16.7040	16.7293	16.7547	16.7800	16.8054
990	16.8308	16.8561	16.8816	16.9070	16.9324	16.9579	16.9834	17.0088	17.0343	17.0599
1000	17.0854									

TABLE 3. Coefficients of the Equation Used to Compute the EMF Values Given in Table 2

The equation for computing values of emf as a function of temperature is of the form:

$$E = a_0 + a_1(t_{90}) + a_2(t_{90})^2 + a_3(t_{90})^3 + a_4(t_{90})^4 + a_5(t_{90})^5 + a_6(t_{90})^6 + a_7(t_{90})^7 + a_8(t_{90})^8 + a_9(t_{90})^9,$$

where E is the emf in millivolts and t_{90} is the temperature in degrees Celsius (ITS-90). The coefficients for the indicated temperature range are:

0 °C to 1000 °C

a_0	=	-0.547124675E-04
a_1	=	0.603578828E-02
a_2	=	0.193678547E-04
a_3	=	-0.222998614E-07
a_4	=	0.328711859E-10
a_5	=	-0.424206193E-13
a_6	=	0.456927038E-16
a_7	=	-0.339430259E-19
a_8	=	0.142981590E-22
a_9	=	-0.251672787E-26

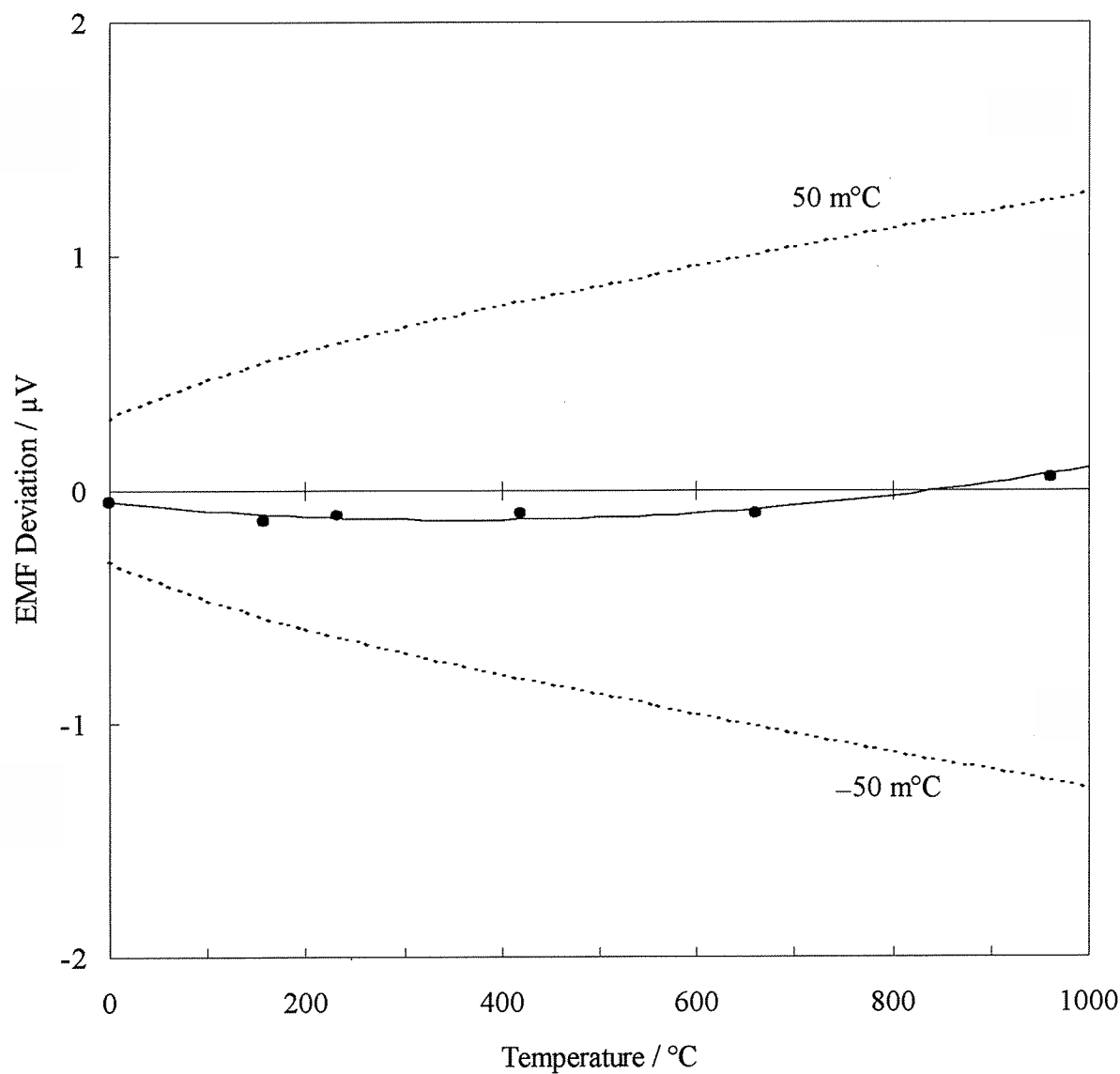


Figure 1: This figure shows the deviation of the emf of the Au/Pt thermocouple from an emf/temperature reference function for Au/Pt thermocouples given in Reference [3]. The deviation equals the thermocouple emf minus the reference function emf. The dots denote measured values and the solid curve is calculated from a polynomial fitted to the data by the method of least squares. The dashed lines indicate an emf deviation equivalent to $0.05\text{ }^{\circ}\text{C}$