U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
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National Bureau of Standards

Certificate

Standard Reference Materials 1460, 1461, and 1462

Austenitic Stainless Steel Thermal Conductivity (λ) and Electrical Resistivity (ρ) as a Function of Temperature from 2 to 1200 K

J. G. Hust and A. B. Lankford

These Standard Reference Materials (SRM's) are to be used in calibrating methods for measuring thermal conductivity and electrical resistivity. They are available in rod form. SRM 1460 is 0.64 cm in diameter; SRM 1461 is 1.27 cm in diameter; and 1462 is 3.4 cm in diameter. All rods are 5.0 cm in length.

T(K)	λ ($W \cdot m^{-1} \cdot K^{-1}$)	ρ ($n\Omega \cdot m$)	T (K)	λ ($W \cdot m^{-1} \cdot K^{-1}$)	ρ ($n\Omega \cdot m$)
			50	6.08	599
2	0.152	593	60	6.98	606
3	.249	593	70	7.72	613
4	.352	593	80	8.34	622
5	.462	594	90	8.85	630
6	.575	594	100	9.30	639
7	.693	594	150	10.94	683
8	.814	594	200	12.20	724
9	.938	594	250	13.31	767
10	1.064	594	300	14.32	810
12	1.323	594	400	16.16	885
14	1.588	594	500	17.78	944
16	1.858	593	600	19.23	997
18	2.132	593	700	20.54	1045
20	2.407	593	800	21.75	1088
25	3.092	592	900	22.86	1127
30	3.763	592	1000	23.90	1162
35	4.404	593	1100	24.86	1197
40	5.01	595	1200	25.77	1234
45	5.57	597			

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by Lee J. Kieffer.

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Stanley D. Rasberry, Chief
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(over)

Measurements

A. Before 1979

Based on low-temperature (below ambient) thermal conductivity, electrical resistivity, and thermopower measurements on three specimens; liquid helium and ice-point electrical resistivity measurements on twenty specimens; and other characterization data such as composition, hardness, density, and grain size [1], the homogeneity of this lot of austenitic stainless steel was determined to be excellent. These measurements indicated that the effect of material variability on thermal conductivity and electrical resistivity is no larger than ±1%.

High temperature (above ambient) data, reported by Fitzer [2] as a result of the AFML-AGARD (Air Force Materials Laboratory, Dayton, Ohio-Advisory Group for Aerospace Research and Development, NATO) reference program, form the basis for extending the temperature range of this SRM to 1200 K. These data have been analyzed and correlated with the low temperature data [1] to obtain the certified values.

B. After 1979

These SRM's were used in an international round-robin study of thermal and electrical properties under the auspices of the Task Group on Thermophysical Properties of CODATA (Committee on Data for Science and Technology). As a consequence of this cooperative program, a considerable quantity of new data and information were obtained [3]. The certified values are changed slightly from the previous values, however, they are within the previously reported uncertainty band except in the vicinity of 7 K.

The estimated uncertainties of the thermal conductivity data, including material variability, are: 2% below 100 K, increasing to 3% at ambient temperature, and 5% above ambient. The estimated uncertainties of the electrical resistivity data, including material variability, are: 1% below ambient and 2% above ambient temperature. The certified values are corrected for thermal expansion.

The chemical composition is given for information only:

Fe	62.0 wt. %	Mn	1.2 wt. %
Ni	20.2	Si	0.28
Cr	16.2	C	<0.01

The density is 8.007 ± 0.002 gm·cm^{-3}

[1] Hust, J.G. and Giarratano, P.J., Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials: Austenitic Stainless Steel, SRM's 735 and 798, from 4 to 1200 K, Nat. Bur. Stand. Special Publication 260-46 (1975).

[2] Fitzer, E., Thermophysical Properties of Solid Materials, Advisory Report 12 (1967); Advisory Report 38 (1972); Report 606 (1972), AGARD, NATO, France.

[3] Hust, J.G., and Lankford, A.B., Update of Thermal Conductivity and Electrical Resistivity SRM's of Electrolytic Iron, Tungsten, and Stainless Steel, Nat. Bur. Stand. Special Publication 260-90 (1984).