

National Bureau of Standards Certificate

Standard Reference Material 799 Electrical Resistivity - Tungsten

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Electrical Resistivity (ρ)* as a Function of Temperature (IPTS-68 and NBS P2-20) (4 to 3000 K)

T (K)	ρ (n Ω ·m)	T (K)	ρ (n Ω ·m)
4	0.650	250	43.93
6	0.650	300	55.5
8	0.651	350	67.5
10	0.652	400	79.8
		450	92.4
12	0.655	500	105.3
14	0.659		
16	0.666	600	132.1
18	0.676	700	159.8
20	0.691	800	188.4
		900	217.3
30	0.865	1000	247.8
40	1.315		
50	2.149	1200	309.6
60	3.393	1400	373.6
70	4.986	1600	438.3
80	6.83	1800	504
90	8.83	2000	571
100	10.93		
		2200	638
120	15.22	2400	706
140	19.56	2600	773
160	23.92	2800	840
180	28.29	3000	907
200	32.70		

*Residual resistivity ratio = 75, residual resistivity = 0.65 n Ω ·m

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 R. E. Michaelis.

Washington, D. C. 20234
 February 27, 1976

J. Paul Cali, Chief
 Office of Standard Reference Materials

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This SRM is available as rods in sintered and arc-cast form of the following sizes:

Sintered tungsten:

799-S1S	(0.32 cm dia, 5 cm long)
799-S2S	(0.32 cm dia, 10 cm long)
799-S3S	(0.32 cm dia, 20 cm long)
799-M1S	(0.64 cm dia, 5 cm long)
799-M2S	(0.64 cm dia, 10 cm long)
799-M3S	(0.64 cm dia, 20 cm long)

Arc-cast tungsten:

799-S1A	(0.64 cm dia, 5 cm long)
799-S2A	(0.64 cm dia, 10 cm long)
799-S3A	(0.64 cm dia, 20 cm long)

Longer rods may be obtained by special order.

Measurements

Low-temperature (below ambient) characterization data [1] consist of thermal conductivity, electrical resistivity, and thermopower measurements on two specimens of sintered tungsten. Liquid helium and ice-point electrical-resistivity measurements were performed on several dozen specimens of sintered and arc-cast tungsten specimens in various heat treatment conditions. Other characterization data such as hardness, density, grain size, and composition were also obtained. These characterization data show that the effect of material variability on electrical resistivity can be in excess of 5% below 90 K. This uncertainty caused by material variability can be reduced to below 2% by measuring the residual resistivity ratio of the specimen; if the value of the ratio is other than 75, use Table 5 [1] for interpolation. The effects of material variability at higher temperatures are within measurement uncertainty.

High-temperature data were obtained on the arc-cast tungsten through the AGARD^a cooperative program on heat-transport properties [2]. The uncertainties of the recommended values are 2% over the entire temperature range, 4 to 3000 K.

These specimens have been annealed at 2300 K for one hour in vacuum. Details of the characterization measurements are presented in the first reference.

[1] J. G. Hust and P. J. Giarratano, Thermal Conductivity and Electrical Resistivity Standard Reference Materials: Tungsten, SRM's 730 and 799, from 4 to 3000 K, Nat. Bur. Stand. Special Publication 260-52 (1975).

[2] Fitzer, E., Thermophysical Properties of Solid Materials, Advisory Report 12 (1967); Advisory Report 38 (1972); Report 606 (1973), AGARD-NATO, France.

^a Advisory Group for Aerospace Research and Development (NATO).