National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material 738

Stainless Steel (AISI 446)

Thermal Expansion

This Standard Reference Material (SRM) is intended for use in calibrating dilatometers used in the measurement of thermal expansion. SRM 738 is available as a 51 mm (2 in) length of 6.4 mm (1/4 in) diameter AISI 446 stainless steel rod. The certified values for SRM 738 are listed in Table 1.

The values of expansion and expansivity were calculated from equations based on least squares analysis of the expansivity data obtained on each specimen. Because this stainless steel goes through a phase transition between 780 and 825 K, thermal expansion has only been certified to 780 K. The total uncertainty of the certified values of thermal expansion include the differences between the specimens and the uncertainty of the measurements.

The thermal expansion of SRM 738 was determined by T.A. Hahn.

The technical and support aspects involved in the original certification and issuance of this SRM were coordinated through the Standard Reference Materials Program by R.K. Kirby and R.L. McKenzie. Revision of this certificate was coordinated through the Standard Reference Materials Program by J.C. Colbert.

CAUTION: Heating the sample above 780 K will result in annealing the sample and invalidating the certification. The values given in Table 2 are not certified and are provided for information only to describe thermal expansion properties of the sample when it has been annealed.

The thermal expansion of this SRM was measured over the temperature range of 293 to 980 K with a Fizeau interferometric method. The expansion of each specimen was measured between equilibrium temperatures. Taking into account the uncertainties in temperature and fringe measurements, the expansivity was determined with a precision of $\pm$ 0.030 x $10^{-6}K^{-1}$. These measurement were made on two specimens that were taken from widely spaced positions in the stock of material that make up this SRM. This stainless steel is identical in composition with SRM 1267 (24.14% Cr, 0.58% Si, 0.315% Mn, 0.29 Ni, 0.093% C, 0.018% P, and 0.015% S). Chemical analyses of a number of samples have demonstrated the homogeneity of this material.

This Certificate of Analysis has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate values or any technical data presented on this certificate.

Gaithersburg, MD 20899
May 24, 1993
(Revision of certificate dated 11-17-86)

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

(over)

Table 1. Expansion and Expansivity of Stainless Steel (AISI 446).

TEMPERATURE	EXPANSION $\Delta L/L_{293}$	EXPANSIVITY α	UNCERTAINTY
293K	0×10^{-6}	$9.76 \times 10^{-6}K^{-1}$	
300	69	9.81	2×10^{-6}
340	466	10.04	8
380	872	10.28	14
420	1288	10.52	18
460	1714	10.76	22
500	2149	11.00	26
540	2593	11.23	29
580	3048	11.47	32
620	3511	11.71	34
660	3984	11.95	36
700	4467	12.19	36
740	4959	12.42	37
780	5461	12.66	37

NOTE: If this SRM is heated above 780 K the resultant annealing will cause a shrinkage of about 115×10^{-6} and a permanent change in its expansivity. The values given in Table 2 are not certified and are provided for information only to describe thermal expansion properties of the sample when it has been annealed.

Table 2. Expansion and Expansivity of Annealed SRM 738. (Noncertified values provided for information only).

TEMPERATURE	EXPANSION $\Delta L/L_{293}$	EXPANSIVITY α
293 K	0×10^{-6}	9.81×10^{-6}
300	69	9.86
340	468	10.09
380	876	10.33
420	1294	10.57
460	1722	10.80
500	2158	11.04
540	2605	11.28
580	3061	11.52
620	3526	11.75
660	4001	11.99
700	4485	12.23
740	4979	12.46
780	5482	12.71
820	5951	10.72
860	6398	11.74
900	6890	12.88
940	7428	14.02
980	8012	15.17