

The Freezing Point of Platinum

RECENTLY ESTABLISHED VALUES IN CLOSE AGREEMENT

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The temperature of the freezing point of platinum now recommended by the Consultative Committee for Thermometry and appearing in the 1975 edition (1) of the International Practical Temperature Scale of 1968 is 1769°C. This represents a change of 3°C from the value of 1772°C which appeared in the first edition of IPTS-68 and which was based upon experimental work carried out in the early 1930s. Before commenting on the new work which has led to the revised value, however, it is worthwhile saying something about the earlier work and how the numerical value of the freezing point of platinum has changed from time to time following revisions to the International Temperature Scale.

The national standards laboratories which contributed to the earlier value for the freezing point of platinum were those of the United Kingdom (N.P.L.), Germany (P.T.R.) and the United States of America (N.B.S.). These laboratories each made measurements between 1930 and 1934 and their respective results were 1773.3°C, 1773.5°C and 1773.8°C on the International Temperature Scale of 1927. Changes in numerical values of temperature took place when the International Practical Temperature Scale of 1948 replaced that of 1927 and again when IPTS-48 was replaced by IPTS-68. Their results converted to IPTS-68 were 1771.5°C, 1771.7°C and 1772°C, hence the original IPTS-68 value of 1772°C.

The first indication that the old value was seriously in error came during work which led to the new International Reference Tables for thermocouples (2). The present author found that a freezing point of 1772°C was inconsistent with measurements of thermo-

couple e.m.f. against temperature made in the range 1064°C to 1760°C. The pure platinum arm of the platinum: 10 per cent rhodium-platinum and platinum: 13 per cent rhodium-platinum thermocouples melted at an e.m.f. equivalent to about 1768°C. Following this observation a proper freezing point determination was carried out at N.P.L. in 1971 using 300 g ingots of platinum, which resulted in a value of $1767.9 \pm 0.3^\circ\text{C}$ (3). Since then similar measurements have been completed at the national standards laboratories of the Federal Republic of Germany, $1769 \pm 0.4^\circ\text{C}$ (4); Australia, $1769.5 \pm 0.5^\circ\text{C}$ (5); and Italy, $1768.9 \pm 0.5^\circ\text{C}$ (6). A further measurement using a method based upon the rapid melting and freezing of platinum ribbons has recently given a value of $1768.2 \pm 0.5^\circ\text{C}$ (7).

In conclusion, therefore, it is now well established that the old measurements were in error by an amount substantially larger than their mutual agreement would have suggested at the time. So far no wholly satisfactory explanation has been found though it is probable that a number of small factors which all happened to be acting in the same direction are the source of the difference.

References

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