New International Temperature Scale

UNITED KINGDOM TO ADOPT ITS-90

The Department of Trade and Industry has announced through its national standards organisation, the National Physical Laboratory (NPL), that it will adopt a new International Temperature Scale as from 1st January, 1990. It will be known as ITS-90, as previously reported in this journal (1). This decision embraces international changes agreed by the Metre Convention, the body concerned with measurement standards world-wide. The changes to values of certain physical phenomena, for example the freezing point of some metals, are of the order of a few tenths of a degree. Possibly this order of change is not large enough to concern many people dealing with everyday temperature measurements, but it is of significance to those working at high levels of accuracy.

There has been considerable scientific activity in thermometry over the last twenty years following the introduction of the IPTS-68, resulting in a much more comprehensive knowledge of the departure of the scale from thermodynamic temperatures. An example of such work has been reported here recently (2). There have also been significant advances in the techniques of practical temperature measurement and instrumentation, allowing a more precise scale to be defined and exploited.

The ITS-90 will follow the same principles as previous scales, its purpose being ". . . to define procedures by which certain specified practical thermometers of the required quality can be calibrated in such a way that the values of temperature obtained from them can be precise and reproducible . . . and approximating the corresponding thermodynamic values as closely as current technology permits". Briefly, the major changes are:

1. Numerical values of fixed temperatures will be adjusted according to published information; these include a change in the freezing point of zinc from 419.58°C to 420°C and of gold from 1064.43°C to 1064°C.

2. The set of fixed points will be revised and extended. Low temperature boiling points will be replaced by melting, freezing or triple points.

3. New mathematical formulation will reduce differences of interpolation between one thermometer and another.

4. Resistance ratios for platinum resistance thermometers will refer to the triple point of water, not the ice point. The criterion of acceptability of platinum resistance thermometers will be their resistance at the melting point of gallium, approximately equivalent to the IPTS-68 requirement of an alpha coefficient greater than $0.003925°C^{-1}$.

5. Alternative interpolations will be allowable over certain ranges.

6. The scale will extend down to 0.65 K.

7. At high temperatures platinum-rhodium thermocouples will be replaced by extending the range of the platinum resistance thermometer to the freezing point of silver (962°C).

8. Radiation pyrometry, based on the Planck Law, will be used at temperatures above 962°C; a blackbody radiator at the freezing point of silver (962°C), gold (1064°C) or copper (1084°C) being used as the reference source.

New fixed points are the triple point of neon (24.6 K), the triple point of mercury (−38°C), the melting point of gallium (30°C), the freezing point of indium (157°C) and the freezing point of aluminium (660°C).

The new scale will be defined in five overlapping ranges: 0.65 to 5 K, 3 to 24.6 K, 14 to 303 K, 0.01 to 962°C, and greater than 962°C. Platinum resistance thermometers will be the defining instruments below 962°C, and radiation pyrometers for temperatures greater than 962°C. B.L.W.

References

1 B. L. Wibberley, *Platinum Metals Rev.*, 1988, **32**, (1), 26

2 C. W. Corti, *Platinum Metals Rev.*, 1988, **32**, (2), 72