

# CCT TG-K

## CCT Task Group for the Realisation of the Kelvin

The terms of reference are to document the techniques for realising the base unit kelvin.

The CCT TG-K is tasked with updates of:

- guides on the realisation of the ITS-90 and PLTS-2000,
- the *Mise en pratique* of the definition of the kelvin (MeP-K),
- data necessary for estimating the influence of impurities on fixed-point temperatures.

- Section 2.1      *Influence of Impurities*
- Section 2.3      *Cryogenic Fixed Points*
- Section 2.4      *Metal Fixed Points for Contact Thermometry*
- Chapter 5:        *Platinum Resistance Thermometry*
  
- Section 2.1:      *Update Appendix 2 (CCT/17-08)*
- Section 2.2:      *Update (CCT/17-05, CCT/17-06, CCT/17-07)*
  
- Chapter 3:        *Vapour Pressure Scales and Pressure Measurements (Draft)*

## *Influence of Impurities*

### Contents:

1. Introduction
2. Effects of impurities in fixed-point samples
3. Methods for estimating the effects of impurities and uncertainties  
(SIE, OME, combined methods, determination of  $T_{LP}$ )
4. Collation of crystallographic parameters
5. Chemical analysis methods
6. Effective degrees of freedom, uncertainties, confidence levels
7. Validation of fixed-point cells
8. Overview of effects of impurities in the ITS-90 fixed-point substances

Future work: Updating of three appendices

## Equilibrium distribution coefficients, slopes of the liquidus lines (Appendix 2):

- ❖ Evaluation of binary phase diagrams
- ❖ Doping experiments
- ❖ Thermodynamic calculations

## Data on precipitation (Appendix 3)

- ❖ Doping experiments
- ❖ Thermodynamic calculations

## Recommended list of common impurities for metallic fixed-point materials of the ITS-90 (Appendix 4)

- ❖ Chemical assays of the producers
- ❖ Analysis results

## Update of Appendix 2 of Section 2.1 *Impurities* (CCT/17-08):

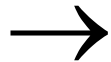
Aggregate values of liquidus-line slope values published in:  
Pearce, Gisby, and Steur *Metrologia* **53**, 1101-1114 (2016)

## Update of Section 2.2 *Triple Point of Water* (CCT/17-05):

New data for the dependence of  $T_{\text{TPW}}$  on the isotopic composition  
(summarized in Document CCT/17-06)

$$\Delta T_{\text{iso}} = -A_{\text{D}} \cdot \delta\text{D} - A_{\text{O}} \cdot \delta^{18}\text{O}$$

$$A_{\text{D}} = 673(4) \mu\text{K} \text{ and } A_{\text{O}} = 630(10) \mu\text{K}$$



## Update of the Technical Annex of the MeP-K (CCT/17-07)

### *Cryogenic fixed points*

#### Contents:

1. Introduction
2. Cryogenic triple-point systems
3. Realization of a cryogenic triple point  
(internal thermal resistance,  $\Delta T_{\text{stat}}$ ,  $\Delta T_{\text{dyn}}$ , determination of  $T_{\text{LP}}$ )
4. Analysis of performance and estimation of uncertainty  
(influencing effects and properties of the fixed-point substances)

Appendix 1: Suggested measurements and measurement conditions

Appendix 2: Recorded data

### *Metal Fixed Points for Contact Thermometry*

#### Contents:

1. Introduction
2. Realizations of metal fixed points for resistance thermometry
3. Fixed-point cell assembly
4. Apparatus
5. Analysis of performance and estimation of uncertainties

Future work: Preparation of an appendix based on the report of CCT Task Group for Sealed Metal Freezing Point Cells (CCT TG-SMFPC)

## *Vapour Pressure Scales and Pressure Measurements (Draft)*

### Contents:

1. Introduction
2. Vapour-Pressure Relations
3. Vapour-Pressure Systems
4. Pressure Measurements
5. Uncertainty of Scale Realization

### New:

- ❖ Extremely large diameters of the pressure-sensing tubes
- ❖ Non-rotating (force-balanced) pressure balances



## *Platinum Resistance Thermometry*

### Contents:

1. Introduction
2. The SPRT definitions in ITS-90  
(alternative interpolation equations for special applications)
3. Design and operation of SPRTs
4. Standard platinum resistance thermometer use and care
5. Experimental sources of uncertainty
6. Uncertainty in SPRT calibrations  
(total uncertainty including non-uniqueness and propagation)

Three appendices (alternative interpolation functions, typical parameters, typical ranges of Type B standard uncertainties)

Necessary action: Restricted access for document CCT/08-19rev

- ❖ Information included in the Guide
- ❖ Obsolete and/or incorrect descriptions
- ❖ Large, not harmonized overlap with different parts of the Guide

0. Foreword and contents (PTB)
1. Introduction (PTB)
2. Fixed Points (PTB)
  - 2.1 Influence of Impurities (PTB): **Appendix 2**
  - 2.2 Triple Point of Water (VSL)**
  - 2.3 Cryogenic Fixed Points (PTB)
  - 2.4 Metal Fixed Points for Contact Thermometry (NPL)
  - 2.5 Metal Fixed Points for Radiation Thermometry (NPL)
3. Vapour Pressure Scales and Pressure Measurements (PTB)
4. Gas Thermometry (INRIM)
5. Platinum Resistance Thermometry (VNIIM)
6. Radiation Thermometry (MSL)

BIPM Website

**Update**

**Draft**

## Guide to the Realization of the ITS-90

- Final version of Chapter 3: end of 2017
- Final version of Appendix 2 of Section 2.1: middle of 2017
- Final version of Section 2.2: middle of 2017
- Final version of SMFPC-Appendix: autumn of 2017
- Final formatting and harmonisation: end of 2017