High-Temperature Fixed-Point Furnace Uncertainty

D Lowe[1], G Machin[1], J Mantilla[2], M J Martin[2], F Girard[3], M Florio[3], M Sadli[4], F Bourson[4], H Nasibli[5] and O Pehlivan[5]
[1]NPL, Teddington, UK; [2]CEM, Madrid, Spain; INRIM, Turin, Italy; LNE-CNAM, Paris, France; TUBITAK-UME, Gebze, Türkey

Corresponding Author: dave.lowe@npl.co.uk ORCID: 0000-0003-1864-7139

High-temperature fixed-points (HTFPs, [1]) with specified values and uncertainties can be used to establish thermodynamic temperature values above the silver point. Current assigned temperatures had their uncertainties arbitrarily increased to make the assignment data consistent; with one or more participating institutes seemingly under-reporting uncertainty values. It was suggested, but not substantiated, that this was because variation in a furnace's thermal environment had not been fully accounted for [2]. As part of further HTFPs' temperature assignment to extend the available options for temperature dissemination[1] [3], the effect of changing temperature gradients on the realization of different HTFP blackbodies has been investigated. The temperature performance of HTFP blackbodies were assessed at different positions and with varying temperature gradients within furnaces. The position with smallest melting range, highest point of inflection and lowest difference between point-of-inflection (poi) and liquidus points was taken to be optimum (e.g, Fig.1). The effect on the poi and liquidus temperatures of different positions and deliberately induced gradients was assessed. The smallest difference was used as the best that could be achieved by careful positioning or setting of furnace set points. These values will be used as part of assigning thermodynamic temperatures to the HTFPs. The uncertainty components for the HTFPs investigated are reported in Table 1, and it is recommended they should be included in any uncertainty budget for HTFPs based on these alloys.

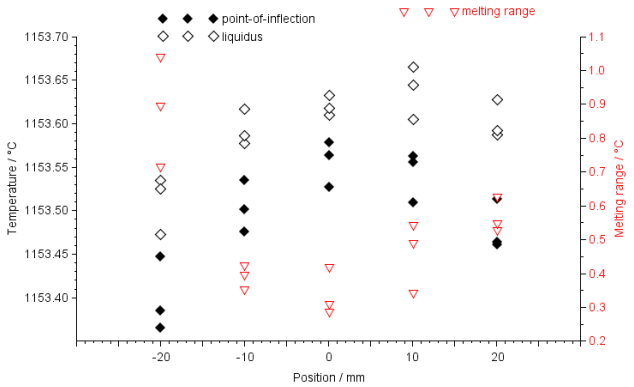

Fig. 1. Positional variation in melting range, point-of-inflection and liquidus for Fe-C in Chino furnace.

Table 1. Uncertainty (k=1) to be added to budget to account for non-uniform thermal environment; best, where the fixed-point position and furnace have been optimised and normal, where they have not.

Fixed Point	Best / mK	Normal / mK
Fe-C	25	30
Pd-C	50	120
Ru-C	30	150
WC-C	75	115

References

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[1] This paper has been written through funding received from the EU EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme, specifically from the EMPIR project 18SIB02 "Realising the redefined kelvin".