National Institute of Standards and Technology
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Reference Material 8172

Copper Freezing-Point Reference (1084.6 °C)

Reference Material Information Sheet

Purpose: Reference material (RM) 8172 is intended primarily for use as a reference point for allowing laboratories to compare their present realization of a temperature scale at the copper freezing-point with NIST's historical realizations of the International Practical Temperature Scale of 1968 (IPTS-68) [1] circa December 6, 1971 and of the International Temperature Scale of 1990 (ITS-90) [2] circa April 12, 1990, where the dates correspond to the dates on the certificates initially provided with SRM 45d and when updated for the transition from IPTS-68 to ITS-90.

Description: RM 8172 was previously offered as Standard Reference Material SRM 45d. SRM 45d no longer meets international quality standards (ISO 17034) for serving as a certified reference material [3]. The remaining inventory of SRM 45d is being offered instead as RM 8172. A unit of RM 8172 consists of a 450 gram bar of a carefully selected cylinder of high-grade copper.

Non-Certified Values: The freezing-point temperature for RM 8172 of 1084.8 °C is relative to ITS-90 and IPTS-68 [4]. It is estimated that the uncertainty does not exceed ± 0. 5 °C. The freezing-point temperature given above is that of representative samples from the lot of material used to establish SRM 45d. The reported temperature values and their uncertainties are based on best practices at NIST when the certificate for SRM 45d was initially created (December 6, 1971) and later revised (April 12, 1990) [4].

Period of Validity: The non-certified values are valid indefinitely within the measurement uncertainties specified, provided the RM is handled and stored in accordance with instructions given in this Reference Material Information Sheet (RMIS). This RMIS is nullified if the RM is stored or used improperly, damaged, contaminated, or otherwise modified.

Maintenance of Non-Certified Value: NIST will continue to monitor this material under the period of validity. NIST will notify the purchaser if substantive technical changes occur that affect the information in this information sheet. Registration (see attached sheet or register online) will facilitate notification.

Safety: RM 8172 is intended for research use.

Storage: The original unopened container should be stored and handled in a clean laboratory environment. Every effort should be made to maintain the purity of this RM through the minimization of handling. Any handling should be done while wearing polyethylene gloves and a face mask.

Use: The user of this material should be familiar with best practices in the operation and handling of metal freezing-point temperature standards and particularly copper freezing-point standards. For examples, see references 3–5.

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Steven J. Choquette, Director
Office of Reference Materials

Information Sheet Revision History on Last Page

REFERENCES

[1] Comité International de Poids et Mesures; *The International Practical Temperature Scale of 1968*; Metrologia, Vol. 5(2), pp. 35-44 (1969).

[2] Preston-Thomas, H.; *The International Temperature Scale of 1990 (ITS-90)*; Metrologia, Vol. 27, pp. 3-10 (1990).

[3] Beauchamp, C.R.; Camara, J.E.; Carney, J.; Choquette, S.J.; Cole, K.D.; DeRose, P.C.; Duewer, D.L.; Epstein, M.S.; Kline, M.C.; Lippa, K.A.; Lucon, E.; Phinney, K.W.; Polakoski, M.; Possolo, A.; Sharpless, K.E.; Sieber, J.R.; Toman, B.; Winchester, M.R.; Windover, D.; *Metrological Tools for the Reference Materials and Reference Instruments of the NIST Materials Measurement Laboratory*; NIST Special Publication (NIST SP) 260-136, 2020 Edition; U.S. Government Printing Office: Washington, DC (2020); available at https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.260-136-2020.pdf (accessed Aug 2021).

[4] SRM 45d; *Copper Secondary Freezing Point*; National Institute of Standards and Technology; U.S. Department of Commerce: Gaithersburg, MD (12 April 1990) available at https://www-s.nist.gov/srmors/certificates/45D.pdf (accessed Aug 2021).

[5] Furukawa, G.T.; Riddle, J.L.; Bigge, W.R.; Pfeiffer, E.R.; *Standard Reference Materials: Application of Some Metal SRM's as Thermometric Fixed Points*; NIST Special Publication 260-77 (1982); available at https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nbsspecialpublication260-77.pdf (accessed Aug 2021).

[6] Evans, J.P.; Wood, S.D.; *An Intercomparison of High Temperature Platinum Resistance Thermometers and Standard Thermocouples*; Metrologia, Vol. 7, pp. 108-130 (1971).

[7] Mangum, B.W.; Furukawa, G.T.; *Guidelines for Realizing the International Temperature Scale of 1990 (ITS90)*; NIST Technical Note 1265 (1990); available at https://nvlpubs.nist.gov/nistpubs/Legacy/TN/nbstechnicalnote1265.pdf (accessed Aug 2021).

Information Sheet Revision History: 27 August 2021 (Updated Period of Validity statement; editorial changes); **22 January 2021** (Original information sheet date).

Certain commercial equipment, instruments, or materials may be identified in this Reference Material Information Sheet to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Users of this RM should ensure that the Reference Material Information Sheet in their possession is current. This can be accomplished by contacting the Office of Reference Materials 100 Bureau Drive, Stop 2300, Gaithersburg, Maryland 20899-2300; telephone (301) 975-2200; e-mail srminfo@nist.gov; or the Internet at https://www.nist.gov/srm.

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