

Development and Realization of Iron–Carbon Eutectic Fixed Point at NPLI

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Abstract: The concept of metal–carbon eutectic temperature fixed point has been introduced in 1999 and is extensively being investigated by thermometry researchers to cover the high-temperature range above copper fixed point. Metal– carbon eutectic fixed points also helped to provide direct traceability with reduced associated uncertainty in the high temperature range for thermometry and radiometry applications. In view of this, CSIR-National Physical Laboratory, India (NPLI) has developed iron–carbon (Fe–C, 1153 C) eutectic fixed point cell in the graphite crucible and realized by using the noble metal thermocouples. The preparation parameters such as design and fabrication of a graphite crucible, Fe:C eutectic composition and filling procedure, furnace profile, melting and freezing plateau measurements, heat flux immersion, inhomogeneity, etc. have been optimized and presented in this paper. The measurement uncertainty of the Fe– C eutectic cell realized with Type-S thermocouple was estimated to be 3.04 IV (0.25 C) at coverage factor $k = 2$.

Keywords: Iron–carbon (Fe–C); Eutectic phase; Melting transition; Thermocouple thermometry; Measurement uncertainty