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Characterization of stirred calibration bath from -80 to 550 °C

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This paper describes the methods of characterizing stirred liquid bath at the National Metrology Institute of South Africa (NMISA) in maintenance and dissemination of the international temperature scale of 1990 (ITS-90). In practice, methods of characterizing stirred liquid baths varies from institution to another as well as manufacturer. This results in either over estimation or under estimation of uncertainty in calibration of thermometers. Generally, the criteria for choosing stirred calibration baths depends on the manufacturer stated stability of time and temperature gradients over the working volume of the bath. The methods used by manufacturer in most specifications are not clearly defined or even stated. As a result, most laboratories develop their own accredited procedures in estimation the effect of the stirred liquid baths in overall uncertainty of thermometer calibration, which in turn differ amongst them.

Through a practical example, the paper describes for three different methods in characterizing stirred liquid baths from -80 °C to 550 °C. Axial or radial temperature gradients were observed as thermometers were placed in different locations in the bath. Furthermore, since the reading of the thermometer(s) changes over time, the methods used are independent of the variation of the bath temperature over time. Hence the uncertainty due to the bath is not over estimated or under estimated. Through these methods, uncertainty in calibration thermometers due to stirred calibration liquid baths were found to be in the range of sub mK to 100 mK from -80 °C to 550 °C.

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