

CCT member and observer Activity Report

Period: January to December 2021

Institute: Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO)

State economy: Brazil

Number of persons involved in thermometry of the institute:

The technical staff is composed of 08 persons (02 doctors and 06 masters).

Short summary of research and development:

- Measurements using infrared forehead thermometers in a black body cavity, developed by Inmetro, to study the reliability of these instruments.
- Design and Development of a silver fixed point cell for radiation thermometry.
- Study of the temperature gradient of a tubular furnace used for radiation thermometry.

Short summary of recent comparison activity:

- SIM.T-S10 (comparison of relative humidity standards from 30 %rh to 90 %rh, at 20 °C and 40 °C, among 09 Latin American National Metrology Institutes): Approved and results published in Metrologia, vol. 58, n° 1A, 2021.
- CCT-K9 (realizations of the ITS-90 from 83.8 K to 692.7 K): Measurements completed by all participants and report in progress.
- CCT-K7.2021 (comparison of water triple point cells): Measurements were already performed at INMETRO and in progress by the other participants.
- SIM.T-S6 (comparison of type S thermocouples): Measurements completed by all participants and Draft A Report in progress.
- SIM.T-S11 (comparison of calibration of industrial PRTs from -40 °C to 420 °C): Waiting to receive the thermometers to start the measurements.

Short summary of other activities:

- Calibration of digital thermometers by comparison, using thermostatic baths and furnaces.
- Calibration of radiation thermometers by comparison, using black body cavity.
- Calibration of platinum resistance thermometers and thermocouples using fixed-point cells.
- Evaluation of thermal baths and furnaces for calibration.
- Performance tests of a two-pressure humidity generator.

Link to bibliography or list of bibliography (last 5 years):

- PEREIRA, M.A.; DINIZ, P.H.F.; TORRES, A.G.; OLIVEIRA, A.R.; QUELHAS, K.N. *Study on the Reproducibility of the Ice Point Realization at the Thermometry Laboratory of Inmetro*. Proceedings of the 11th Brazilian Congress of Metrology. Online, 2021.
- LOZANO, B.M.; QUELHAS, K.N.; TARELHO, L.V.G. *Manufacture and Evaluation of an Open Zinc Freezing Point Cell as Temperature Reference Standard for the Thermometry Laboratory of Inmetro*. Proceedings of the 11th Brazilian Congress of Metrology. Online, 2021.
- SOHN, R.S.T.M. *Understanding the Radiation Thermometers*. 240th ECS Meeting, J. Phys.: Conf. Ser. **1826** 012031, Digital Meeting, 2021.
- BRIONIZIO, J.D.; et al. *Interlaboratory Comparison of Relative Humidity Standards among Latin American National Metrology Institutes (SIM.T-S10)*. Metrologia, vol. 58, n° 1A, 03001, 2021.
- BRIONIZIO, J.D.; SKABAR, J.G. *Bilateral Key Comparison of INMETRO and INTI Humidity Standards in the Dew/Frost-Point Temperature Range from -30 °C to +60 °C (SIM.T-K6.7)*. Metrologia, vol. 57, n° 1A, 03002, 2020.
- DINIZ, P.H.F. *Calibração de Termômetros de Radiação por Pontos Fixos: Operacionalização e Primeiras Medições*. Proceedings of the Brazilian Congress of Quality in Metrology – Enqualab 2020, São Paulo, 2020.
- CHAGAS, R.; BRIONIZIO, J.D.; RIBEIRO, L.C.; GARCIA, G.A.; TARELHO, L.V.G. *Comparação entre o Atraso Troposférico Zenital Determinado pelo Método PPP para Medições Realizadas por Satélites e o Valor Determinado pelo Modelo de Hopfield para Medições Meteorológicas de Superfície*. Proceedings of the 10th Brazilian Congress of Metrology, Florianópolis, 2019.
- QUELHAS, K.N. *O novo kelvin no SI*. Cadernos de Metrologia, Inmetro, 2019.
- TEW, W.L.; QUELHAS, K.N. *Realizations of the Triple Point of Sulfur Hexafluoride in Transportable and Refillable Cells*. Journal of Research of the National Institute of Standards and Technology, vol. 123, p. 123013, 2018.
- BRIONIZIO, J.D.; ORLANDO, A.F.; BONNIER, G. *Characterization of a Spherical Heat Source for Measuring Thermal Conductivity and Water Content of Ethanol and Water Mixtures*. Int. J. Metrol. Qual. Eng., vol. 8, p. 18, 2017.
- FREITAS, B.B.; SOHN, R.S.T.M.; PEREIRA NETO, M.A. *Aspectos Metrológicos da Termografia na Indústria de Petróleo*. HOLOS (Online), vol. 1, p. 279-291, 2017.
- FLAVIO, M.L.; QUELHAS, K.N. *Avaliação de Métodos para Calibração de Indicadores de Temperatura com Compensação Eletrônica da Junção de Referência (CEJR) para Sensor Termopar*. Novas Edições Acadêmicas, 1st Ed., 68 p., 2017.
- DINIZ, P.H.F.; TEIXEIRA, R.N.; TARELHO, L.V.G. *Construção e Avaliação de Termopar Pt/Pd para Utilização em Fornos de Alta Temperatura*. Proceedings of the 9th Brazilian Congress of Metrology. Fortaleza, 2017.