Contribution ID: **261** Type: **Oral (Non-Student) / orale (non-étudiant)**

Low-temperature primary thermometry development at NRC

Thursday 19 June 2014 14:30 (15 minutes)

Experimental evidence suggests that the International Temperature Scale of 1990 (used for commercial and academic thermometer calibrations) deviates from thermodynamic temperature over a broad temperature range below the triple point of water. However, unexplained inconsistencies between data sets limit the usefulness of this data as a basis for a new temperature scale. In order to resolve these inconsistencies, more experimental data is needed, particularly that collected using other methods of primary thermometry. One such technique that has not previously seen much use at low temperatures is Refractive Index Gas Thermometry (RIGT).

Preliminary work on a low-temperature microwave RIGT implementation for primary thermometry at the National Research Council Canada (NRC) and the next steps to complete the development of this technology will be reported.
A prototype quasi-spherical copper resonator has been integrated into a cryogenic system with a 5 K base temperature, and microwave measurements in vacuum have been completed to characterize the resonator between 5 K and 297 K. The dependence of experimental results on spectral fitting background terms, first- and second-order shape corrections, and waveguide corrections has also been explored.

The current NRC results agree with previous room-temperature measurements on the same resonator at the US National Institute of Standards and Technology (NIST), and indicate no significant change in resonator shape between room temperature and low temperature. The temperature dependences of the resonator electrical conductivity and linear thermal expansion coefficient, as obtained from the microwave resonances, agree with published literature values for oxygen-free high-conductivity (OFHC) copper measured using other techniques.

Author: Dr ROURKE, Patrick (National Research Council Canada)

Presenter: Dr ROURKE, Patrick (National Research Council Canada)

Session Classification: (R2-5) Industrial and Applied Physics - DIAP / Physique industrielle et appliquée - DPIA

Track Classification: Instrumentation and Measurement Physics / Physique des instruments et mesures (DIMP-DPIM)