

“BNC Seminar”

Monday, March 28, 2016 @ 10:00am
BRK, ROOM 1001

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Title: Recent advances in radiation thermometry standards and applications

Bio: Yoshiro was born in Tokyo, Japan in 1959. He received the BEng and MEng degrees in Instrumentation Physics from the University of Tokyo in 1983 and 1985, respectively. He then joined Nippon Kokan KK (currently JFE Steel Corp.) and worked on optical systems for *in situ* measurement and inspection in steel production, including immersion optical-fiber thermometer for molten steel and emissivity-free radiation thermometer for steel coating line. During this time, in 1992 he received the MEng degree in Electrical Engineering from California Institute of Technology, USA. In 1998 Yoshiro joined the National Research Laboratory of Metrology (currently National Metrology Institute of Japan (NMIJ), AIST), and has since been involved in research in radiation thermometry standards and industrial applications. In 2002-2003 he worked as guest researcher at the Bureau International des Poids et Mesures (BIPM) in France. Yoshiro is currently responsible for realization and dissemination of the high-temperature radiation temperature scale in Japan. He is currently Prime Senior Researcher at the NMIJ.

Abstract: Reliability in radiation thermometry has not yet been sufficiently well established to meet industrial demands. New developments are being made to overcome the obstacles, in both standards and application techniques.

The International Temperature Scale of 1990 (ITS-90) is a scale that approximates the thermodynamic temperature, and defines temperatures at a selected set of “defining fixed points”, the highest of which is the Cu point (1084.62 °C). Above this, the scale is extrapolated according to the Planck’s law of blackbody radiation, and therefore suffers from degradation of measurement accuracy as the temperature goes high. To overcome this, at the NMIJ, AIST, we proposed a series of novel high-temperature fixed points (HTFPs) of metal-carbon alloys that covers the temperature range above the Cu point to above 3000 °C. A multi-national project, launched in 2007 among Meter Convention member states, was concluded last year with the fixed point temperature values determined with uncertainties considerably smaller than the current ITS-90 realization uncertainty.

Unknown emissivity is an inherent problem that has impaired high accuracy application of radiation thermometry in practice. We have proposed a novel technique that utilizes thermal images to realize emissivity-free thermometry through measurement of reflectance-ratio.

In this talk, an overview is given on the HTFPs of metal-carbon systems, on the multi-national HTFP project, and on trend in high-temperature standards in relation to the planned redefinition of the SI unit kelvin. Measurement principle and application test results are presented on the emissivity-free thermometry of electronic devices.