CCT-WG5 Activity Report to CCT

Chair: Graham Machin, NPL
Date of report: 04 May 2010

Terms of reference of WG5 are to study and advise the CCT on issues related to thermal radiation methods for temperature measurement and to develop and maintain an effective liaison with the Consultative Committee for Photometry and Radiometry.

Working Group 5 is tasked with:
• the evaluation of thermodynamic measurement results at higher temperatures,
• the examination and coordination of activities related to high-temperature fixed points,
• providing appropriate input into the *mise en pratique* for the definition of the kelvin,
• provide where required updates for *Supplementary Information for the ITS-90*,
• where necessary, provide definitive guidance for secondary non-contact thermometry methods,
• support world efforts in thermal imaging standardization,
• generate appropriate uncertainty budgets for radiation thermometry.

Taken from the minutes of the 24th meeting of the CCT, 2008.

Membership
A*STAR (Wang Li), CEM (Maria Jose Martin Hernandez), INMETRO (Renato Teixeira), INRIM (Mauro Battuello), KRISS (Chul Woung Park), LNE-INM (Mohamed Sadli), MSL (Peter Saunders), NIM (Zundong Yuan), NIST (Howard Yoon), NMIA (Mark Ballico), NMIJ (Juntaro Ishii), NMI-VSL (Eric van der Ham), NPL (Graham Machin, chair), PTB (Joerg Hollandt), SMU (Peter Nemecek), UME (Ahmet Diril), VNIIM (Mikhail Matveyev), CCPR official representative (Nigel Fox)

Co-opted members
NIM, formerly NMIJ and VSL, (Pieter Bloembergen), NIM (Tiejun Wang), NPL (Emma Woolliams, for MeP-K HT Task Group), PTB (Juergen Hartmann), VNIIOFI (Boris Khlevnoy), NMIJ (Yoshiro Yamada)

Introduction
A summary of activity by the WG5 is given in this report from 21st May 2008 to date. The draft agenda of the WG5 meeting to be held at BIPM 6th May 2010 is given in Annex 1.

Summary of activity
Membership: Since the last CCT meeting WG5 gained two new members; CEM (Maria Jose Martin Hernandez), INMETRO (Renato Teixeira), and two new co-opted members NIM (Tiejun Wang) and NPL (Emma Woolliams, for *MeP*-K HT Task Group)

Meetings: Two meetings were held I) an informal WG5 meeting on 21st Oct 2008 at Tempbeijing and II) 11th Sep 2009, at PTB of the *MeP*-K HT drafting group, PS joining via an intermittent video link. The minutes, agenda and action record of the first of these meetings can be found on the BIPM website CCT-WG5 (open), weblink: http://www.bipm.org/wg/CCT/CCT-WG5/Allowed/Miscellaneous/MinutesofInformalCCT-WG5meetingTempbeijing2008.pdf.

The second of these meetings was held to progress the formulation of the *MeP*-K HT. The formal documents can be found (as of 23rd April 2010) on the restricted area of the CCT website, CCt/10-12, -13 and -14.
In addition a workshop under the auspices of CCT-WG5, entitled, "International Workshop on High Temperature Fixed Points Solutions for Research and Industry", was held at KRISS, immediately after Newrad '08, on 17th Oct 08. Our Korean colleagues are thanked for their hard work in organising this workshop. Information about the workshop, including the presentations can be found at http://newrad2008.kriss.re.kr/newrad2008/, username: newrad2008, password: daejeon

Formal activities:
The main activities of WG5 have been the production of the text for the *MeP*-K HT, and progressing the HTFP research plan.

High temperature fixed point research
Work on HTFPs, and in particular the CCT-WG5 research plan is making good progress. HTFPs of Co-C, Pt-C and Re-C have had initial long-term stability assessed. PTB has made baseline assessments of these HTFPs, the *T* values were then measured at NPL, NIST and are currently being measured by NMIA. These will then return to PTB for assessment. A second round of measurements will then be undertaken involving LNE-Cnam, KRISS and VNIIOFI. This circulation will provide a baseline assessment of the status of world radiometry, and recommendations for improvements in primary radiometric thermometry. Innovative work has been undertaken at, in particular, LNE-Cnam and NMIJ to solve on-going robustness problems with Co-C. A set of high quality cells of Co-C, Pt-C and Re-C will be made in 2011 for final *T* assignment by enhanced primary radiometry in 2011-2012. This sub-set of HTFPs will then have agreed consensus temperatures through the CCT (2013). Many papers have been prepared describing the technical work associated with the WG5 research plan and these will be presented at Tempmeko '10.

WG5 Task Group for MeP-K HT text
A task group of members and co-opted members from WG5, Howard Yoon (NIST), Juergen Hartmann (PTB), Emma Woolliams (NPL), Yoshiro Yamada (NMIJ), Pieter Bloembergen (NIM/NMIJ) and Peter Saunders (MSL) was formed to produce suitable text for the *MeP*-K. The background text is complete, except for a footnote regarding refractive index, two short sections for the *MeP*-K have been produced, one for "direct methods" and one for "indirect methods" for realising and hence disseminating *T* above the silver point. These are all currently on the restricted access part of the CCT website and are listed CCT/10-12, -13 and -14. It is anticipated that -13 and -14 will be incorporated into the main-body of the *MeP*-K, whereas -12 will serve as a background document supporting the radiometric temperature measurement parts of the *MeP*-K. All these will become open documents after final approval by the CCT. The *MeP*-K HT work of WG5 will form a keynote address at Tempmeko '10 and there will also be a dedicated session at Tempmeko '10 arising from the work of this task group describing different technical aspects of radiometric temperature measurement.

Standardisation of radiation thermometers and thermal imagers
WG5 members are contributing to both the following committees. Both committees are meeting at the forthcoming Tempmeko & ISHM 2010 conference (Slovenia).
1) JHt is the chair of an IEC committee concerned with specification standards for radiation thermometers. A standard was published in 2008 giving the definition of the specification

parameters, a second document is currently being prepared on the determination of those parameters.
2) GM is chairing a recently constituted IEC committee charged with developing specification standards for thermal imagers. The plan is to identify and then describe the parameters for FPA thermal imagers and to have a standard in place before the end of 2011. This committee will have an extended meeting (12-15 Oct 10) at the main ISO/IEC plenary meeting in Seattle.

CCT-WG5 meeting
The CCT will meet 4-7 May 2010 and WG5 will hold a half-day meeting on the morning of the 6th May. The agenda of this meeting is to be found in Annex 1.

Other meetings
CCT-WG5 has organised two technical workshops of interest to its members. At Tempmeko '10 there are two planned meetings associated with WG5 activities, both on 4th June. In the morning there will be the second meeting of the Blackbody Users Group (BBUG) – this is organised in cooperation with PTB radiometry colleague Peter Sperfeld. A programme is to be found at: http://www.tempmeko-ishm.org/Blackbody-Users-Group-meeting-2010-final.pdf. All who have an interest in high temperature blackbodies and furnaces are welcome to attend this meeting.

In the afternoon there will be a review the progress, and planning the next steps of the HTFP research. This meeting is open to participants of the CCT-WG5 research plan and an outline programme can be found at; http://www.tempmeko-ishm.org/HT-Fixed-Points-CCT-WG5-2010.pdf

Annex 1: Agenda of CCT-WG5 meeting 6 May 2010

Chair: Graham Machin
Time: 8:30-13:00
Location: BIPM, Paris

8:30-8:45 Welcome (GM), members introduction (all)
8:45-9:00 Review of minutes and action record of last meeting (21st May 2008)
9:00-9:15 Review of terms of reference and tasks – any recommendations for changing these to be proposed to the CCT?
9:15- 9:30 The mise-en-pratique for the kelvin at high temperatures (GM)
9:30-10:00 New measurements of ITS-90 defining fixed points (MS, MB, others)
10:00-10:15 IEC Specification standard for radiation thermometers (JHt)
10:15-10:30 IEC Specification standard for thermal imagers (GM)
10:30-10:45 Uncertainty document for thermal imagers – how/if/when to proceed
10:45-11:00 High Temperature Fixed Points (HTFP), research plan progress (GM, MS, JH) – part I
11:00-11:20 Coffee
11:20-11:40 High Temperature Fixed Points (HTFP), research plan progress (GM, MS, JH) – part II
11:40-12:30 Earth Observation requirements (presentation by NF, followed by discussion)
12:30-12:45 Discussion re future KC
12:45-12:55 Radiation thermometry text for updated "supplementary information"
12:55-13:00 AOB, Announcements – meetings at Tempmeko '10, New kelvin dissemination workshop, Next meeting Newrad 11?
13:00 Close of meeting