Seminar on LED Colour and Colour Rendering Properties Measurement and Relevant Standards

9 Nov 2012 (Friday), 9.30 am to 12.00 pm

Auditorium, Level 1, TÜV SÜD PSB building,
1, Science Park Drive, Singapore 118221
[Location map]

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Introduction

LEDs are increasingly being used as general illumination sources due to their high efficacy and durability. But do LEDs provide high quality lighting? Two important measurements of lighting quality are: Chromaticity of light (whether the light appears warmer/cooler or greenish/pinkish) and Colour rendering (the ability of the lighting to render colours of the objects under its illumination).

Chromaticity of light is measured by chromaticity coordinates or by correlated colour temperature (CCT, unit: kelvin [K]) and the distance from the Planckian locus (Duv). For most interior lighting applications, warm white (2700K to 3000K) and neutral white (3500K to 4000K) light are typical in European countries and USA. Higher CCT (5000 K to 7000 K) tends to be preferred in Asia. Some lightings use cool-white LEDs with very high CCT (more than 6500K, bluish in appearance) since the current white LEDs tend to offer higher efficacy at lower cost at higher CCT. Colour rendering property is normally measured using colour rendering index (CRI). CRI is a quantitatively measurable index of the quality of a light. A perfect broadband light like an incandescent light bulb or the day light from the Sun has a CRI value of 100. Although the CRI has been found to be problematic for RGB (red, green, blue) and narrow-band LED systems, it remains the standard method for colour rendering property evaluation of general lighting including LED lights. The National Institute of Standards and Technology (NIST), USA has developed a Colour Quality Scale (CQS) that is intended to replace or supplement the current CRI. CQS is designed to solve the problems of CRI and to provide the scores that correlate well with perceived colour rendering.

NMC is organising this seminar focusing on LED colour and colour rendering. Dr Yoshi Ohno, the developer of CQS at NIST, USA, has been invited to give a presentation on "LED colour and colour rendering properties measurement and relevant standards". Dr Ohno is a NIST Fellow and has been the Group Leader for Lighting and Colour Group, NIST, USA, and also serves as the CIE Vice President Technical. His group maintains the national standards of the lumen, candela, and other photometric units and colorimetric scales for USA, and developed the CQS. The seminar will be relevant to technical staff working in the LED industry who would like to learn about colour and colour rendering properties measurement of LED lightings. The seminar also provides an excellent platform for participants to discuss technology and application issues faced by the local LED community.

Programme

9.00 am	**Registration**
9.30 am	**Welcome and Opening Address**
9.40 am	**LED Colour and Colour Rendering Properties Measurement and Relevant Standards** Dr Yoshi Ohno, NIST Fellow and the Group Leader for Lighting and Colour Group, National Institute of Standards and Technology (NIST), USA Abstract: Colour quality of lighting has two aspects, the chromaticity of light and the colour rendering. Chromaticity is often expressed by correlated colour temperature (CCT) but it is only one of the dimensions of chromaticity. Another important dimension is the distance from Planckian locus (defined as Duv in USA), which is often neglected. We will discuss the importance of Duv and its important effects in perceived colour quality in relation to the ANSI C78.377 standard. We will then look at the problems of the CRI for LED sources and how Colour Quality Scale (CQS) can improve the evaluation and design of colour quality of SSL products. Some results of vision experiments using NIST Spectrally Tunable Lighting Facility will be presented and status of the CIE work will be reported.
10.30 am	**Tea Break**
11.00 am	**LED/SSL Photometry and Radiometry Facilities at NMC** Mr Liu Yuanjie, Assistant Head (Optical Metrology) and Senior Metrologist National Metrology Centre Abstract: LEDs are increasingly being used as general illumination sources due to their high efficiency and durability. The lighting principle of LED is different from traditional light sources such as incandescent light bulb and fluorescent tubes. The optical measurements of these light sources are more difficult than others. Several types of light measurements are applicable to LEDs, which can be possibly achieved by different measurement technologies. For instance, the total luminous flux of a LED lamp can be measured by means of an integrating sphere photometer calibrated by a total flux standard lamp, or alternatively by a goniometer with its detector calibrated using a spectral irradiance standard lamp. This presentation will cover LED measurement technologies and facilities currently available at NMC. The key factors affecting the measurement accuracy of LED lights and proper correction methods for these factors are discussed. Developments for new measurement facilities are also introduced.
11.40 am	**Q&A**
12.00 pm	**End**

Who should attend

Researchers, engineers, designers and manufacturers, system integrators, purchasers and contractors, students and users of LEDs and lighting systems, from universities, research institutes and industry should find the topics useful and informative, as well as anyone interested in LED lighting in general.

Registration

Registration for the seminar is free of charge. Seats are available on a first-come, first-served basis. Please register online through the link below (or click here), or by email to Ms Nor Muliaty Awi (nor_muliaty_awi@nmc.a-star.edu.sg) (Tel: 6279 1905), with your name, designation, company, email address and phone no.

Contact Us

For technical enquiries, please contact:

- Mr Liu Yuanjie, email: liu_yuanjie@nmc.a-star.edu.sg or Tel: 6279 1940

For industry matters, please contact:

- Mr Ng Tong Jin, email: ng_tong_jin@nmc.a-star.edu.sg orTel: 6279 1974

About the Speakers

Dr Yoshi Ohno, NIST Fellow and the Group Leader for Lighting and Colour Group, NIST, USA

Dr Yoshi Ohno is a NIST Fellow and the Group Leader for Lighting and Colour Group at Sensor Science Division, National Institute of Standards and Technology, USA. His group maintains the national standards of the lumen, candela, and other photometric units and colorimetric scales for USA. He received his Ph.D. in engineering from Kyoto University, Japan. He started his career at Panasonic Corp., Osaka Japan before joining NIST in 1992. Dr Yoshi Ohno is actively involved in research of photometry and colorimetry. Specific projects of interest include integrating sphere theory, luminous flux measurement, colorimetry of light sources, colour rendering, spectroradiometry, photometry of flashing lights, and solid state lighting. He served as Director of CIE Division 2 for 2007-2011, and currently serves as CIE Vice President Technical. He is a Fellow of IESNA, NIST representative for CCPR, Chair of CCPR Working Group of Key Comparisons, and is active in technical committees in CIE, ISO, ANSI, and IESNA. Dr Ohno received several awards including the CIE de Boer Gold Pin Distinguished Service Award in 2007 and U.S. Department of Commerce Silver Medal Award in 2009.

Mr Liu Yuanjie, Assistant Head (Optical Metrology) & Senior Metrologist, National Metrology Centre

Mr Liu is a Senior Metrologist in the Optical Radiation Lab of National Metrology Centre (NMC). His expertise includes development and application of measurement technologies and standards for the photometry, spectroradiometry, spectrophotometry and colorimetry. Since joining NMC in 1998, he has developed the NMC Reference Spectrophptometer for spectral regular transmittance measurement, a Spectral Irradiance Calibration Facility, an Automatic Multi-Wavelength Filter Radiometer (MWFR) for the realisation of a detector-based spectral irradiance measurement scale, CIE averaged LED Intensity Measurement Facility and LED Total and Forward Flux Measurement Facility.