Publishable JRP Summary Report for ENG62 MESaIL Metrology for Efficient and Safe Innovative Lighting

Background

The European 2020 Strategy is pursuing the overall objective of saving 20% of the Union's primary energy consumption by 2020. This is possible when for instance energy efficiency of innovative lighting is enhanced, by improving product quality and assuring longer lifetime.

Initial commercial first generation SSL products, based on LED technology, suffered from reduced light quality and variable performance. At first, the development of basic metrology for SSL (ENG05 "Metrology for Solid State Lighting") has led to considerable improvements towards the reliable measurement of SSL performance.

The gradual maturing of SSL technology has led to a steady increase in product quality and enhanced efficiency, but demands an advanced metrology framework. This JRP will strengthen the metrological framework for novel SSL, notably OLEDs/OLED arrays and pulsed SSL. This JRP will make a first step towards meeting metrological needs for nano-structured and flexible LED systems.

Advancement of the metrology framework will be accomplished through: 1) development of missing measurement methods and equipment, 2) delivery of traceability for pulsed SSL and lifetime, 3) quality improvement by developing metrics accounting for health aspects and 4) assuring excellence via collaboration with academic research and impact via close collaboration with stakeholders (Industry, test laboratories and standardisation bodies). This JRP aims to speed up standardisation process by its major contribution to written standards on international (CIE) and European (CEN) levels.

Need for the project

SSL technology is developing continuously and new types of SSL products frequently appear on the market, notably OLED and flexible LED, phosphor-free LEDs and pulsed LED systems. These products have distinct characteristics, which have to be taken into account in the measurement procedure to avoid measurement errors.

Measurement solutions have to be developed to deal with large area and curved light emitting surfaces (e.g. OLED and flexible SSL). Metrics and validated measurement procedures have to be developed to cover safety and health aspects. To drive novel SSLs new electronic circuits are developed. Electrical characterisation has to keep pace with these developments.

The need for reliable methods for lifetime determination is broadly felt. End-users are not ready to pay for unproven/unlabelled highly priced products. Lifetime is an important factor to determine accurately, because it not only governs the long-term quality experience of users, but it also underpins economic models for lamp replacement. User confidence may be damaged by faulty lifetime estimates and uptake will suffer.

Since metrology for SSL covers a wide set of parameters, some related to optical output, some to electrical aspects, some to reliability and some to perception and safety, a broad expertise is indispensable. Only through the cooperation of NMIs and academic partners with complementary knowledge and facilities will this JRP succeed strengthening the metrological framework for SSL and create the expected impact.

EMRP
European Metrology Research Programme
Programme of EURAMET

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EURAMET
European Association of National Metrology Institutes

Scientific and technical objectives

The aims of this project are to deliver an advanced metrological framework for novel SSL by providing transfer standards applicable at NMI and test laboratory level, to develop measurement solutions for large area and pulsed SSL, to provide metrics and equipment accounting for safety and comfort aspects of novel SSL, and to assure longer lifetime and provide its traceability.

The technical objectives of this JRP are:

Objective 1. Develop sets of optical and electrical reference standards to calibrate as well as to characterise the setups used in testing laboratories and to verify their capability to perform particular measurements of novel SSL;

Objective 2. Improve measurement methods and decrease uncertainty in 1) photometrical parameters of OLED measurements, 2) electrical power measurements of AC-operated (developing an impedance stabilisation network) and pulsed SSLs. Study the feasibility of using standard measurement equipment for 3D complex goniometric measurements of large area and complex SSL (3D nano-structured);

Objective 3. Deliver a full set of metrics for safety and comfort aspects of novel SSL through development of full measurement solutions and by performing physiological studies on (a) flicker/stroboscopic effect, (b) blue hazard, (c) well-being/comfort experience and (d) lighting quality perception.

Objective 4. Develop measurement solutions and establish traceability for lifetime and reliability testing of SSL products. Investigate various aging mechanisms involved in material degradation of novel SSL devices.

Objective 5. Create high impact through: 1) close collaboration with – and promotion of developed measurement solutions (for pulsed SSL and lifetime) among – industrial stakeholders, 2) promotion of the developed transfer standards for testing laboratories worldwide, 3) establishment of a reportership in CIE to recommend creation of a technical committee and publication of international CIE recommendations based on the work of Objective 1, and 4) delivery of guidelines and matrices for safety and comfort aspects to the relevant TCs in CIE /CEN.

Expected results and potential impact

This JRP will deliver an advanced metrological framework for novel SSL. This will enable the reliable measurement of SSL performance in the broadest sense, including basic light output and efficacy, but also light distribution, light quality, light perception, safety aspects and life-time aspects. A particular emphasis will be on novel SSL technologies, which, with the proper metrological support, will become more important in years to come.

The JRP has a projected impact across the entire SSL value chain, providing developers, designers, producers, distributors and end-users with the tools they need to improve, predict and specify SSL performance based on reliable measurements.

Europe is an active member of global lighting market and holds a traditionally strong position. Leading European industrial stakeholders make a significant contribution to the gross domestic product of the EU and to employment levels across Europe. However, competition from outside Europe is growing rapidly. An advanced metrological framework will assure the competitive advantage of European industry and safeguard against unfair competition.

A particular emphasis in the JRP will be on providing input to standardisation activities. Efficient knowledge transfer to International and European standardisation organisations (CIE, ISO and CEN) is embodied in the JRP. Several dedicated reports, relevant guidelines and recommendations will be delivered. For instance, a formal reportership to CIE Division 2 will be established to facilitate the dissemination of the results.

For end-users the improved energy efficiency will help to reduce energy bills and the availability of reliable data on light output, energy consumption, safety/health aspects and life-time will allow informed and objective decisions.

JRP start date and duration:	1 June 2014, 36 months
JRP-Coordinator: Elena Revtova, Dr., VSL, Tel: +31152691640 E-mail: erevtova@vsl.nl JRP website address: http://www.eng62-mesail.eu/	
JRP-Partners: JRP-Partner 1 VSL, The Netherlands JRP-Partner 2 CMI, Czech Republic JRP-Partner 3 CSIC, Spain JRP-Partner 4 INRIM, Italy JRP-Partner 5 LNE, France JRP-Partner 6 METAS, Switzerland	 JRP-Partner 7 MIKES, Finland JRP-Partner 8 PTB, Germany JRP-Partner 9 SP, Sweden JRP-Partner 10 TUBITAK, Turkey JRP-Partner 11 Inmetro, Brazil JRP-Partner 12 OSRAM, Germany
REG-Researcher (associated Home Organisation):	Andreas Waag TUBS, Germany
REG-Researcher (associated Home Organisation):	Henderikus Wilhelmus van Zeijl TU Delft, The Netherlands

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