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New JRP proposal Call Pre-normative

Towards documentary standards for BRDF based quantities

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EMRP
European Metrology Research Programme
Programme of EURAMET
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→ PRT (15) → JRP proposal → JRP

EMPIR Call 2016 – Energy, Environment, Normative and Research Potential

Selected Research Topic number: **SRT-n01**
Version: 1.0

Title: Towards documentary standards for BRDF based quantities

Abstract

The commercial success of a product can be dependent on its aesthetic appearance. For this reason, industrial manufacturers are continuously looking to develop new attractive visual effects. The control and characterisation of these effects requires the development of a traceability chain based on the Bidirectional Reflectance Distribution Function (BRDF). Primary references and standard artefacts have recently been established at the NMI level and commercial measurement devices have also been developed. However, the field of BRDF measurements still suffers from the lack of standardisation. Proposals in response to this SRT should address this issue by developing, in the framework of CIE normative activity, guidance on the measurements of BRDF, gloss and sparkle.

Keywords

Goniospectrophotometry, gloss, goniochromatism, iridescence, BRDF, colour, appearance, sparkle, materials

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Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on metrology research necessary to support standardisation on BRDF based quantities.

The specific objectives are:

1. To propose standard parameters for the measurement of the BRDF of particular materials and optical surfaces in the visible range in order to improve the traceability to the SI between users and NMIs, and therefore to allow for better agreement between commercial goniospectrophotometers. The focus should be on i) settings of apertures, ii) illuminated and measured areas, and iii) convergence of light beams.
2. To provide guidance on how to sample the BRDF space efficiently and to propose a minimum number of measurement geometries according to the appearance properties of the specimen. In addition, to propose arrangement for data handling and processing for BRDF measurements when a large amount of data is obtained.
3. To propose a new method for gloss measurement that correlates with visual perception. The contribution should be based on i) reflectance measurements, ii) visual evaluations and iii) definition of a standard gloss observer.
4. To propose a consensual definition of sparkle and graininess measurands and to define procedures for their measurement in correlation with visual scales for sparkle and graininess.
5. To facilitate the uptake of the technology and guidance developed in the project by the measurement supply chain e.g. instrument manufacturers and end-users e.g. automotive, cosmetics, pigments, packaging and 3D printing industries. In addition, to contribute to the standards development work of international standardisation bodies e.g. CIE. Dissemination of project results should take place as early as possible to establish a standardised approach.

○ *Details of submitter*

	Name	Organisation / Affiliation	Country
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○ *Optional details of co-authors*

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Letter of support

Letters of support from industrial and normative stakeholders are essential to support the proposal **sept 2016**

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BASF Coatings GmbH, Postfach 61 23, 48136 Münster

To whom it may concern

Münster, September 1st, 2015

Letter of Support for the JRP NRM-09:
"First development of normalization on BRDF based quantities"

Dear Sir or Madam,

Herewith we would like to express our interest in and support for the planned joint research project "First development of normalization on BRDF based quantities" (JRP NRM-09) within the frame of the EMPIR Call "pre-co-normative".

Our company, BASF's Coatings division, develops, produces and markets innovative automotive coatings, automotive refinishes and industrial coatings as well as decorative paints. We operate sites in Europe, North America and South America as well as Asia Pacific. Within this network, we collaborate closely with our customers all over the world. In 2014, the Coatings division achieved global sales of about €3 billion. More information about the division is available at www.basf-coatings.com.

Our interest is focused in particular in:

- Bi-directional Reflectance Distribution Function measurement
- Gloss measurement
- Evaluation of sparkle and graininess effects.

We are highly interested in the topic of the proposed JRP, and are willing to follow and to use the outputs of this work.

Yours sincerely,

BASF Coatings GmbH

Klaus-Dieter Plitzko Jürgen Niemann

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Geschäftsführung: Thomas Hartmann; Hans-Peter Klein
Aufsichtsrat: Markus Kamieth (Vorsitzender)

afnor
NORMALISATION

Afnor Standard Commission Colour and Colorimetry X08D was kept informed and consulted about the European project proposal entitled :

First development of normalisation on BRDF based quantities.

This European project could be financed according to the European Metrological Program for Innovation and Research (EMPIR Project proposal N009).

Afnor Standard Commission Colour – Colorimetry X08D wants to express his high interest for this project with the following comments.

Since about fifteen years at least, the Bi-directional Reflectance Distribution Function (BRDF) is become a very important quantity for the characterization of the visual appearance of a large number of materials. We think here about materials that are more and more used in areas like painting, plastics, coatings, ornaments, and so on, and show peculiar visual aspects with effects of gloss, sparkle, graininess, that aim more or less to reproduce visual effects observable in our natural environment.

In this field, no recommendation exists to give guidelines in order to help instrument manufacturers, or research and development laboratories. It is thus urgent to start researches coordinated at an international level on this subject, in order to avoid in a near future a confused situation that can become a drag for industry and trade of these new materials.

On gloss topic, the normalization issue has been already raised up by Dr J. Schanda more than 40 years ago (*Memorandum on the problem of defining and measuring gloss, CIE Committee E.1.3.1, Barcelone, 1971*) and a CIE document has been published on this matter in 1986 (*Publication CIE 118/1 : Collection in colour and vision – Evaluation of the attribute of appearance called gloss, 1986*). But, unfortunately, no concrete normalization decision has followed.

It is evidence that existing devices devoted to the measurement of gloss hasn't today the capacity to evaluate properly the subtlety of this visual attribute that is essential in visual appearance. They only provide a rough idea of the directional reflectance properties of manufactured products that can help in monitoring the production. A normalization action in this field would be extremely useful and urgent.

In conclusion, Afnor X08D Commission (Colour and Colorimetry) wants to express its full interest for the project proposal EMPIR N009 cited above and wish that this project encountered a favourable decision in order to launch the work and to produce concrete decisions on the BRDF derived quantities. The Afnor X08D Commission propose to play a role of observer on the projected work and to bring its expertize to the consortium through regular exchanges. Afnor will not bring financial support.

The Afnor X08D Commission intends of course to use the outputs of the project when the work will be completed.

Robert Sève
Chairman of the "Afnor - Couleur Colorimétrie X08D" Commission
October 2015

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Thank you