



Measuring sparkle

The colour or sparkly finish of cars effects how well they sell. Paint effects using metal or mica flakes that shimmer like stars in the sky are an eye-catching effect. Achieving a uniform finish over the entire car is a production challenge due to the variety of materials used. Manufacturers need reliable measurement methods to assess complex paint effects but currently these do not exist.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Sparkle – an effect created by small flakes of mica, glass or aluminium in paint to produce a glistening finish, is important in the automotive, printing and cosmetic industries where visual appearance directly influences sales.

Our perception of colour and sparkle varies depending on lighting conditions, as demonstrated by changes in a car's appearance between bright sunshine and a cloudy day. Understanding these changes and being able to accurately measure surface effects during development and quality control as cars leave the production line is essential for optimising sales. Measuring complex visual effects achieved on a variety of materials – metals, plastics and composites is extremely difficult. It involves illuminating components from different angles in sequence and recording the strength of the reflections created. This data is then fed into complex models to predict our perception of colour and sparkle. To ensure that perception models match the effect we see, light booths are used to compare results from expert consumer panels and instrumentation viewing the same samples under the same lighting conditions.

Ensuring that pigment suppliers and their industrial customers make comparable measurements is essential if product quality is to be maintained. Currently there are no standard procedures or instrument calibration methods to provide confidence in result accuracy. Perception models, originally designed for solid colours, are not suitable for complex effects like sparkle and require further development. New standardised approaches to measurement methods, calibrations for complex effects, and models to link these to human perception are all needed to enable comparable measurements.

Solution

The EMRP project, *Multidimensional reflectometry for industry*, characterised sparkle paint samples, provided by coatings manufacturer BASF, and used these to investigate how instrument measurements using many different light positions could be simplified without losing accuracy. The project team also upgraded light booths to improve the accuracy of links between perception based instrument measurements and panels of experts viewing samples for sparkle and other complex effects.

Impact

X-Rite, producers of precision colour measurement instruments for product design, formulation and production, was one of the first to use the image based measurement equipment characterised within the project to confirm the sparkle attributes of samples with effect pigments. This confirmed the performance of their measurement instruments and provides both X-Rite and their customers with greater confidence in the results these generate.

Car manufacturer, Audi uses complex paint coatings across its range that must appear uniform no matter to which material they are applied. Audi were early users of project validated light booths set-up for sparkle measurements. This enabled them to identify a mismatch between expert panel assessments of colour samples and the perception models they use with instrumentation results.

As a result of growing industrial concerns over measurement comparability and the validation of perception models for sparkle effects, the international commission on illumination, the CIE, has set up a new working group to investigate these complex visual effects. Representatives from across the European supply chain will work towards a harmonised approach for determining complex visual effects and reliable perception models to increase confidence in new surface finish measurements which are important for product quality assurance.

Measuring complex visual effects reliably

The EMRP project *Multidimensional reflectometry for industry*, increased the accuracy of measurements used to determine quantitatively how light interacts with surfaces, and developed standards and statistical models to match measurements to our perception of complex visual effects. Reliably linking visual effect perception of complex finishes such as gloss, sparkle and texture to those made by instruments has the potential to increase product sales, prevent unnecessary re-working of nearly perfect components and enable QA automation. These types of measurements are essential for ensuring continued success in industries where visual attributes are key to economic success such as in the automotive, printing and cosmetic sectors.



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