

IT'S ALL ABOUT THE SURFACE

Rhopoint TAMS™ - an innovative new measuring system for characterising the visual quality of functional and decorative surfaces



The measuring methods used for characterising the visual impression have been highly complex and mainly the domain of experts. In order to obtain a quick and uncomplicated statement concerning the visual quality of a surface, after several years of collaboration between specialists from Volkswagen AG, Audi AG and English company Rhopoint Instruments Ltd. an innovative measuring device has been developed which reproduces human perception – the Rhopoint TAMS™ (Total Appearance Measurement System).

The appearance of painted surfaces is of paramount importance to all premium coating companies and particularly automotive manufacturers, since the first visual impression of the surface quality of a product that the customer gets can have a considerable effect on the subsequent purchasing decision. The quality of painted surfaces should therefore be perceived by the customer as visually appealing, which is influenced by the colour and particularly the structure of the surface.

Conventional measuring instruments rely on users who interpret the highly complex values of several measuring devices as an actual visual appearance. This can lead to ambiguous communication about the nature of surfaces, e.g. between the manufacturer and the companies that supply add-on parts. Difficulties in correlating between measured values and the visually experienced impression can result in a finish which does not fulfil the manufacturer's expectations, even though all of the conventionally measured parameters are within tolerance.

In order to optimise the painting processes, several years ago Volkswagen AG initiated a comprehensive innovation project which dealt with examining and improving the basic procedures in measuring automotive finishes, among other things. The project led to the development of a completely new instrument technology by Rhopoint Instruments Ltd. (UK), a company that specialises in evaluating the perception of the appearance.

An important part of the project was intensive investigation of human perception, which was carried out at AUDI AG. The joint development of definitions and computing models was needed for a comprehensive description of the visual impressions of the observer.

The human eye looks at surfaces by running through two different types of focusing – focusing on short distance for evaluating surface structure and defects, and focusing on the reflections and contours of a surface at so-called showroom distance, i.e. the distance of approx. 1.5 m which an observer generally adopts for visual evaluation.

When doing this, the observer's brain runs through various estimations and the basis for his reaction is: "Does the product look good"? or "Do neighbouring parts have a harmonious and homogeneous effect"?, processes which ultimately have an effect on the purchase decision.

The Rhopoint TAMS™ simulates these processes by imitating the functions of the human eye and mapping the mechanisms that take place in the brain using double focus image technology and imaging and computing systems at a high-tech level. The Rhopoint TAMS™ records the images at different focus levels and computes the characteristics with the aid of perception algorithms.

Based on this knowledge, special recording of the visual appearance impression is possible. Easily understandable measured variables were chosen which make clear communication between all responsible internal and external links in the vehicle delivery chain possible.

The Rhopoint TAMS™ uses four parameters to produce a comprehensive description of the visual sensation: Contrast, picture sharpness, waviness and dominant structure size (dimension).

Contrast is related to the colour of the surface; white and metallic surfaces have low contrast, whereas deep black surfaces have a high contrast (100 %).



Reflection on a white surface
C= 40%



Reflection on a black surface
C= 100%

Sharpness quantifies the accuracy of images reflected by a surface, 100 % indicates a perfect reflection.



Blurred view

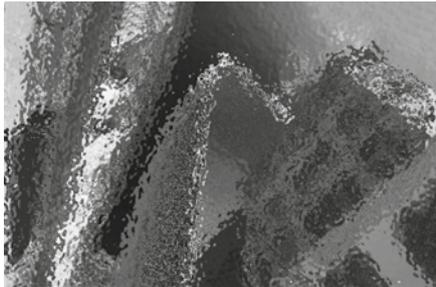


Sharp view

Waviness is a measure of the visual impression that surface waves evoke in an observer at showroom distance (1.5 m), and is derived from human sensations. Surfaces with low waviness tend to be preferred by the viewer.

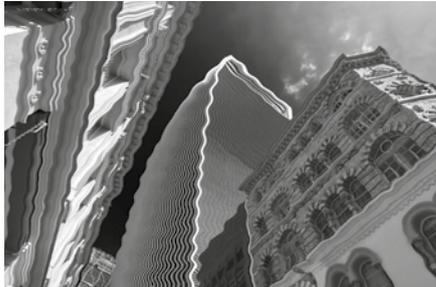


Smooth surface

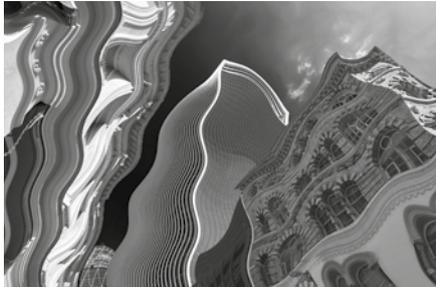


Wavy surface

Dimension, on the other hand, indicates the dominant structure size perceived at showroom viewing distance. The dominant structure size is important for determining the harmony of two neighbouring parts.



Surface with small structure dominance



Surface with large structure dominance

Although these parameters alone can be used for evaluation, a significant advantage of the Rhopoint TAMS™ is that these parameters can be combined to form two new values: The quality coefficient and the harmony coefficient.

The quality coefficient (Q) is an individual value that summarises the overall appearance of a surface, whereby 100 % represents a completely smooth surface with a perfect visual impression.

The harmony coefficient (H) was developed in order to evaluate the acceptance of two neighbouring parts. A value of >1.0 indicates that the visual quality of the neighbouring parts is felt to be interfering by the observer.

These two values are the decisive prerequisite for making a PASS/FAIL evaluation possible for a final quality check in the production line and/or establishing intervention limits.

Based on optical metrology, the Rhopoint TAMS™ is a significant step forward in the measurement of automotive and premium high-gloss coatings, because it quantifies the visual experience and makes it easier to interpret and pass on the results. The technology of the Rhopoint TAMS™ provides a comprehensive view of a wide variety of surfaces, from steel as a carrier material to the various intermediate layers such as KTL and filler and as far as the top coat. The Rhopoint TAMS™ therefore helps to optimise the surface finish and provides new quality criteria that are not subject to the subjective influences of visual evaluation.

The universal technology of the Rhopoint TAMS™ will make other customer-specific evaluations methods feasible in the future, whereby Industry 4.0 plays an important role.

As a long-time distribution partner of Rhopoint Instruments, Konica Minolta Sensing will look after the marketing and distribution of Rhopoint TAMS™ with its global distribution network. The new device is the perfect complement to Konica Minolta's comprehensive range of colour and light measurement solutions for the automotive industry and its suppliers.

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