

The Appearance Standard in the Automotive Industry

wave-scan DOI

The paint finish of a car has two main requirements: protect the surface underneath and enhance the quality of the overall product. Eye catching finishes should not only have a beautiful and rich color, but look like a mirror "high gloss and perfectly smooth" - and of course not diminish over time.



Uniform appearance on the entire car stands for high quality.

Therefore, automotive companies define color and appearance standards to specify an acceptable finish. Especially important is the uniformity - it must be consistent over the entire vehicle. Critical is the uniformity within the horizontal and vertical panels and the harmony between car body and add-on parts. That means how well do the add-on parts - such as bumpers, spoilers, door handles, fuel doors and decorative trim - match the adjacent body panels. Differences are especially obvious on models with zero gap styling.

In the past the appearance was described with a variety of terms such as glossy or brilliant or dull - wet look or snap - orange peel - smooth. Today the wave-scan is the standard to objectively quantify appearance of the painted body and off-line painted parts at all major car companies.

micro-wave-scan - the solution to evaluate the harmony between car body and add-on parts

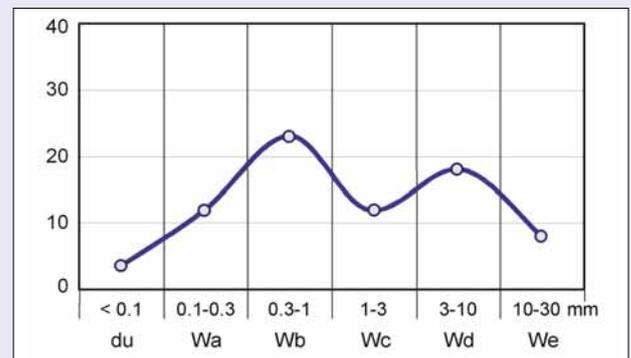


wave-scan DOI - the standard to control appearance on the car body chosen by all major automotive makers:

Aston Martin - Audi - BMW - Daewoo - Daihatsu - DaimlerChrysler - Fiat - Ford - GM - Honda - Hyundai - Jaguar - Lamborghini - Lotus - Mitsubishi - Nissan - Peugeot - Porsche Renault - Rolls Royce - Saab - Seat - Toyota - Volvo - VW

By assigning an objective value to the appearance quality lengthy and heated discussions between automotive producers and their suppliers do no longer exist.

In addition, the measured data can be used for trouble shooting to improve the quality. The wave-scan DOI and micro-wave-scan measure various structure sizes to evaluate the perception of the appearance quality - close up and at a great distance. The obtained measurement results, the so-called structure spectrum, support process and material engineers to optimize material properties and application parameters. This achieves the highest possible quality.



Structure spectrum - the fingerprint of surface appearance.

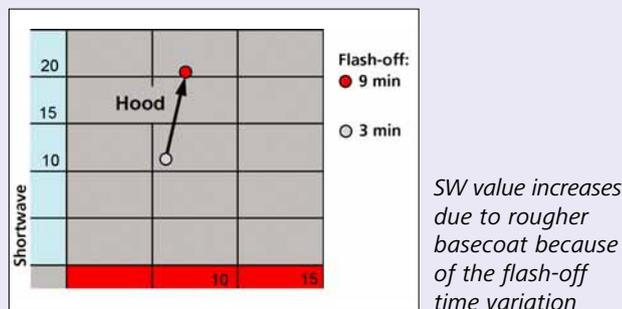
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Structure Spectrum – a Diagnostic Tool for Trouble Shooting

The structure spectrum clearly shows what structure sizes are on the surface finish – it can be compared with the fingerprint of the surface appearance. Analyzing the entire structure spectrum and evaluating the ratio of the various structure sizes helps to explain the visual perception and the possible cause.

For example, the substrate quality can influence the final appearance. As an automotive finish is a multi-layer system, the quality of each layer could possibly telegraph through the final clear coat layer. Very often substrate quality issues can be seen in increased shorter waves (SW or Wa – Wb). In the following graph an increase of flash-off time caused a “rougher” basecoat, which could be mainly seen in a higher shortwave value.



Another example for influence of substrate quality is described in the following pictures. Initially the sample surface shows a high amount of shorter waves (Wa, Wb) dominating our visual perception. By sanding the primer surface the shorter waves were drastically reduced resulting in a very glossy appearance. Due to the high gloss the longer waves (Wd) are much more apparent. This is a good example to illustrate the importance of the ratio between long waves (Wd) and short waves (Wb) in regards to the visual perception.



High amount of shorter waves



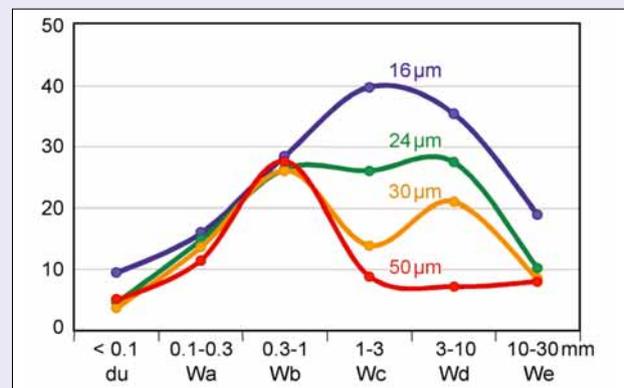
Shorter waves (Wb) are lower than long waves (Wd)
→ Poor longwave coverage

In order to achieve a more smooth looking paint finish it is preferable to have a slightly higher amount of Wb than Wc (ratio 1.5:1 or 2:1).



Shorter waves (Wb) are higher than long waves (Wd)
→ Good longwave coverage

On the other hand a high long wave could for example be caused by an insufficient amount of clear coat.



Increasing clear coat (2K) film build improves the flow and leveling behavior of the finish

The following table shows some possible causes for the various structure sizes and can be used as a guide to get started analyzing surface appearance.

Dullness is too high	Clear coat looks milky Very fine textures caused by material properties
Wa is too high	Substrate influence Dry spray of clear coat
Wb is too high	Substrate influence
Wc is too high	Insufficient amount of clear coat Sanding marks Very rough substrate
Wd is too high	Insufficient amount of clear coat Very rough substrate

“wave-scan DOI – more than just an instrument to check specifications – the solution to optimize appearance”.