

The effect of the basecoat thickness on the Orange Peel and DOI measurement of a paint coating.

Julie SURIN

Introduction

In the automotive industry, Orange peel and DOI (Distinctness of Image) of the paint coating applied on bumpers are important features of the final aspect. (Figure 1)

It is very important to maintain uniformity between the added bumper and other parts of the car; excessive variation is visible to the human eye and leads to customer rejection.

Hence, Orange peel and DOI control represents an essential stage in the bumper's production. In accordance with the customer's book of specifications, the PP (measurement scale of orange peel and DOI), as evaluated by the Wave-Scan instrument, must be above 65.

Paint coating is constituted by three coats: the undercoat, the basecoat (gives the colour) and the clearcoat (gives the brilliance).

The aim of the study consists of reducing the basecoat thickness and analysing its affect on the appearance.

Experimental Conditions

Nowadays, the Wave-Scan is the standard tool of all major car companies, used to objectively quantify appearance as well as analyze surface quality. The instrument evaluates the size of the structure (orange peel) and the brilliance of the surface (DOI).

A laser point light source illuminated the sample at a 60° angle and a detector measured the reflected light intensity. The instrument scanned the surface and measured the reflected light intensity point by point. The optical profile of the surface was then detected (structure: 0.1 – 30 mm). A green LED illuminated the surface at 20° and a CCD camera analyzed the reflected image of the light source's (LED) aperture. The "DOI" was expressed (structure < 0.1)

The thickness of the paint coats, were then examined under a microscope. These analyses were performed on April 22nd and April 24th after the first reduction in basecoat thickness, and on April 29th following a second reduction. Four bumpers were analysed each day.

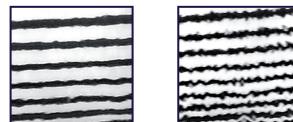
Results and discussion

The orange peel texture and DOI of the paint coating were successfully improved. The PP increased from 60 to 70, thanks to a reduction in basecoat thickness by 5 µm. (Figure 2)

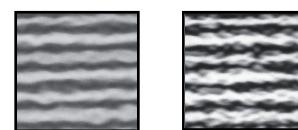
Indeed, because of an excessive basecoat thickness, we noted an insufficient drying of the paint layer. A high proportion of the permeated clearcoat was absorbed by the basecoat, causing dullness and or orange peel effects on the gloss as the film dried or aged.

Conclusion

Decreasing the basecoat thickness offers many advantages: it substantially reduces the impression of orange peel and the dullness effect of the clearcoat. The quality of the final aspect fulfils the customers' requirements. Furthermore, this modification offers a considerable amount of paint saving.



The Orange Peel effect : is a defect representative of large surface ripples in a painted surface due to the macro-geometrical distortion. The paint film having an uneven texture that resembles of the skin of an orange.



The DOI : (distinctness of image): reflected image clarity due to the micro-geometrical distortion in a painted surface.

Figure 1 : Orange peel effect and DOI of a paint coating applied on bumpers are important features of the appearance.

Figure 2 : The values PP on the bumpers is significantly increased after a reduction in basecoat thickness.