

Paint Thickness Measurements on CFRP Automobile Parts

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1. Introduction

Automobile parts are more and more made from carbon fiber reinforced plastic (CFRP). Primarily these are of black color. The parts generally have to be painted, especially on the exterior side. This is necessary to obtain the color desired by the customer. But even in the case of visual carbon they have to be painted transparently for an ultraviolet (UV) protection.

This protection needs a minimum thickness of the paint. However, it should not exceed a maximum thickness because of possible peel off problems. Therefore the paint thickness has to be controlled in close tolerances. It is self-evident that the necessary measurements are to be done non-destructively.

Because of the special material properties, however, nondestructive paint thickness measurements on CFRP are not possible with such methods which are used for measurements of paint on metal. A rather sophisticated ultrasonic instrument is available for this purpose. And, since recently, the simple to handle paint thickness gage FSC1 from FI Test- und Messtechnik GmbH is available. This instrument uses a microwave based test method. It is already in use in the aircraft industry. This application note describes a new application in the automobile industry.



Figure 1: Paint thickness gage FSC1 consisting of the measuring module and the display module.



Figure 2: BMW M6 Gran Coupé

2. The paint thickness gage FSC1

The paint thickness gauge FSC1/6 consists of two modules: the measurement module and the display module, see figure 1. The instantaneous measurement area is about 2 cm². The measurement time is about 2 seconds. The substrates may be isotropic or anisotropic and may have medium or high electrical conductivity

The readout is independent of the dielectric constant (permittivity) of the isolating layer. In case of layered paint material the complete thickness is measured. Usually, the calibration is performed by the user on the CFRP substrate material in use and with plastic calibration foils.

3. Paint thickness measurements on the roof of the BMW M6 Gran Coupé

The roof of the BMW M6 Gran Coupé is of visual carbon and is UV protected by a transparent paint, see fig. 2. The objective is to determine this paint thickness distribution. Therefore first the FSC1/6 was calibrated on one of the roofs that was prepared for painting but not yet painted. This calibration used plastic foils of known thickness and took about 4 minutes.

After that the FSC1/6 is now used to measure the paint thickness distribution on the roofs in the series production. The pure measurement time on one measurement point lasts about 4 seconds.

4. Conclusion

Using the paint thickness gage FSC1 the expenditure for the painting of carbon composite parts in the automobile industry can be considerably reduced when compared with previous measurement methods. As an example, this was shown on the painting of roofs of the BMW M6 Gran Coupé.

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