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AN INFLUENCE OF CAR WASHING ON THE THICKNESS OF LACQUER COATING

Summary

In the work the problem of the destructive impact of hand washing car on a lacquer coating, in the case of non-compliance of the principles of washing, was undertaken. This problem was investigated on sample of car body sheet with lacquer coating polluted by dust and road dirt. Two instruments of world-known producers were used for the measurements. The distributions of lacquer coating thickness were obtained on the reference sample (uncontaminated) as well as after several cycles of hand washing without water rinse of the dust and road dirt. A visual assessment was performed. It was found measurable loss of lacquer coating on sample taken after the operations of manual washing without the initial removal of loose layer of road dirt.
Key words: *car washing, lacquer coating, distribution of coating thickness*

WPŁYW MYCIA SAMOCHODU NA GRUBOŚĆ POWŁOKI LAKIERNICZEJ

Streszczenie

W pracy podjęto problem destrukcyjnego oddziaływania ręcznego mycia samochodu na warstwę lakieru w przypadku niezachowania zasad mycia. Problem ten badano na próbce blachy karoseryjnej z powłoką lakierniczą, zanieczyszczaną kurzem i brudem drogowym. Do pomiarów użyto dwóch przyrządów pomiarowych znanych producentów światowych. Uzyskano nimi rozkłady grubości powłok lakieru na próbce referencyjnej (nie zabrudzonej) oraz po kilku cyklach myć ręcznych bez spłukania wodą kurzu i brudu drogowego. Prowadzono ocenę wzrokową. Stwierdzono mierzalny ubytek warstwy lakieru na próbce po wykonanych operacjach mycia ręcznego bez wstępnego usunięcia luźnej warstwy brudu drogowego.
Słowa kluczowe: *mycie samochodu, powłoka lakiernicza, rozkład grubości powłoki*

1. Introduction

A large number of automotive vehicles in use determines the demand for their cosmetic service. To the basic actions of cosmetic service include the washing and conservancy of exterior elements of vehicle, covered by lacquer coating as well as cleaning its interior. The washing, in addition to the aesthetic aspect, allows to detect damages of the coating, increase its durability, facilitate the vehicle service and increase a traffic safety. Washing vehicles serve car washes. Not all car washes have appropriate and efficient equipment and not always is respected the proper washing technology, adapted to the type of a vehicle and the pollution of lacquer coating. When washing manually or automatically it can happen mistakes arising from ignorance or because of cost savings. These mistakes cause accelerated wear or damage of the coating.

Washing, as well as other processes, requires the special preservation technology regime and the appropriate means. Properly carried out a car body washing does not cause deterioration of the properties and noticeable reduction in coating thickness, even in the long term and has a positive effect on the durability of the car body, increases its aesthetics and a road safety [1, 2]. On the other hand, failure to comply with the correct order of steps washing or omission of any of these, may cause changes in the condition of the lacquer coating. Particularly important for the proper washing is to flush dust and road dirt (pre-washing), which significantly affects the washing on the thickness and condition of the automotive lacquer coating. In this paper, the problem of improper washing the vehicle is closer presented, especially the influence of not removed dust and road dirt on the thickness of the lacquer coating during the manual cleaning of the car body is investigated.

2. Purpose and scope of the investigation

A considerable efforts have been made in order to conduct the investigations as close as possible to reality. These investigations have been carried out on sample taken from the body sheet of door passenger car. In the studies, as contamination of the sample, a dust and road dirt, which usually settle on the external elements of a motor vehicle were used. The sample was taken from the bottom of the car door, where pollutants are especially intense when the vehicle is not equipped with a cover element in the form of protective apron.

The aim of the investigation was to evaluate the effect of improper washing a motor vehicle on the wear of car lacquer coating, estimated by the loss of coating thickness. By the term "improper washing" is meant – above all – the omission of an initial removal of relatively loosely embedded road dust and dirt on the car body, so called as pre-washing, i.e. flushing road dirt with aid of water under low pressure.

3. Methods of investigation

The wear of the lacquer coating of the vehicle body fragment was assessed by change (distribution) of coating thickness. The investigation was carried out using two instruments, allowing for fast and accurate measurement of the thickness of the lacquer coating. KD-Leptoskop 2050 produced by Karl Deutsch Company was used with a simple probe 11.4 mm (Fig. 1) and Mini Test 730 instrument

manufactured by ElektroPhysik Company with a probe on the cable (Fig. 2). This kind of instrument was already used to determination of lacquer coating thickness of the car body in various cases [3, 4].

The study's scope covered a manual washing of the dirty sample without the initial removal of a road pollution. This was the contamination of dust and road dirt, gathered on the car body on a randomly selected city street. The lacquer coating thickness measurements were carried out in 5 series. Between each series of measurements were performed 5 times (in the cycle), alternating contamination and washing the sample. The repetition of measurements performed in each of the measuring points were determined by statistical calculation after the completion of pilot studies [5]. On the basis of this calculation it was accepted a 10-fold repetition of measurements in each of the 20 measurement points of samples drawn up with the aid of the template.

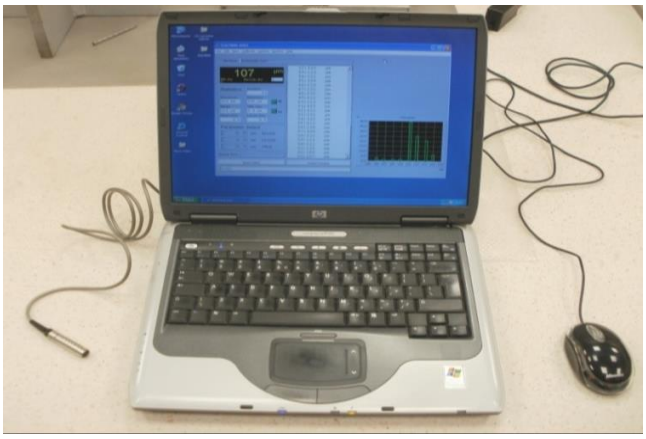

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Fig. 1. KD-Leptoskop 2050 manufactured by Karl Deutsch
Rys. 1. Leptoskop KD 2050 – produkt firmy Karl Deutsch

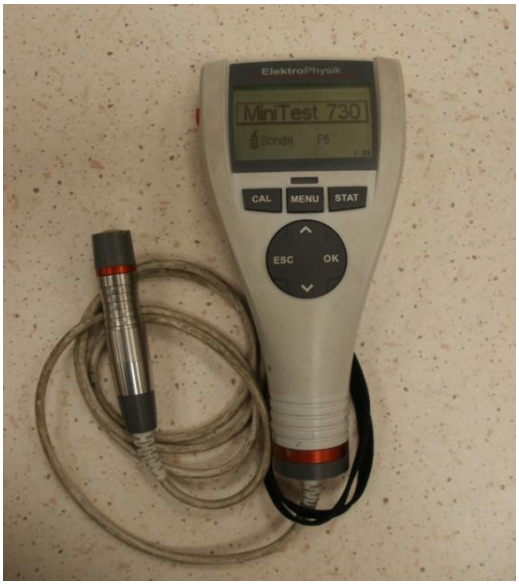

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Fig. 2. The instrument MiniTest 730 manufactured by ElektroPhysik
Rys. 2. Przyrząd MiniTest 730 produkcji firmy ElektroPhysik

To the sample was designed and made the template for measurement, therefore the measurements in the following series were performed in the same places. In the template the net of 20 holes with a diameter of 8 mm was prepared, which determined the points of measurement, i.e. the places where the probes of measuring instruments were applied [5]. This template was placed to the sample and immobilized. As a result, it was possible to avoid shifting the template relative to the sample. In this way, the likelihood of a subsequent series of measurements in other areas than in the preceding series was minimized.

The thickness of the lacquer coating was measured every five washing cycles, respectively, before washing and after 5, 10, 15 and 20 washing cycles. The sample, before the first measurement was gently cleaned and washed with clean water using a soft cloth. The next step, after the initial series of measurements, included contamination of the sample surface by dust and road dirt during the cycle of urban ride (Fig. 3) [5].

Fig. 3. A contaminated sample prepared for washing [5]
Rys. 3. Zanieczyszczona próbka przygotowania do mycia [5]

Contaminated and dried sample was subjected to a manual washing with a sponge without using the pre-wash, involving rinsing and moistening the dirt by the jet of water under slight pressure. The sponge, as is during the typical washing process, was soaked with water. The process of washing during the investigations was not supported by any chemical means.

4. Results and analysis

The results of the lacquer coating thickness measurements carried out on the prepared sample are shown graphically in Figs 4 to 10. Figures 4 and 5 show graphs of coating thickness at baseline, before washing. Figures 6 and 7 show examples of selected distributions of coating thickness in the final stages of the investigations.

Analyzing the graphs in Fig. 4 and 5, it can be concluded that the distributions of the thickness of the coating before washing contain the lacquer coating – in principle – only in two ranges of thicknesses. The thickness distributions of lacquer coating on the sample were similar in the case of using two different measuring instruments (Fig. 1 and 2), which positively determines the credibility of the results. After the last washing cycle, the uneven coating material losses on the sample was recorded (Fig. 6 and 7).

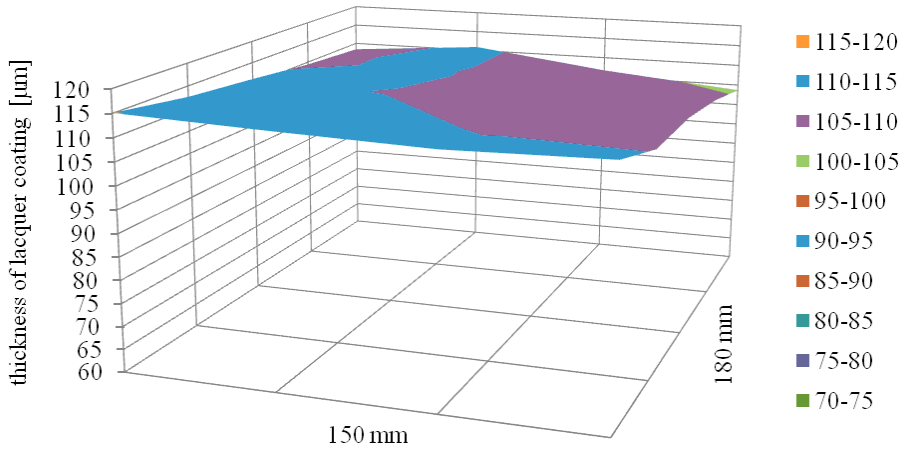

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Fig. 4. Distribution of the thickness of the lacquer coating on a sample of car body sheet before washing operation, performed by the instrument KD-Leptoskop 2050

Rys. 4. Rozkład grubości powłoki lakierniczej na próbce blachy karoseryjnej przed wykonaną operacją mycia wyznaczony za pomocą przyrządu KD-Leptoskop 2050

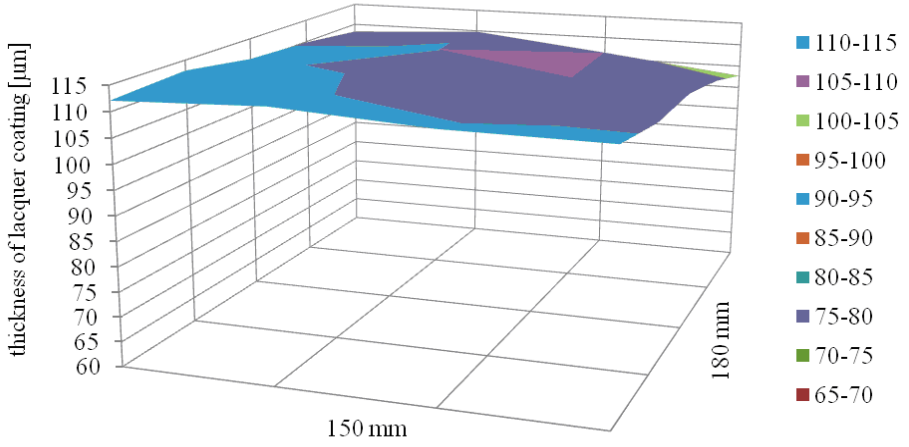

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Fig. 5. Distribution of the thickness of the lacquer coating on a sample of car body sheet before washing operation, performed by the instrument MiniTest 730

Rys. 5. Rozkład grubości powłoki lakierniczej na próbce blachy karoseryjnej przed wykonaną operacją mycia wyznaczony za pomocą przyrządu MiniTest 730

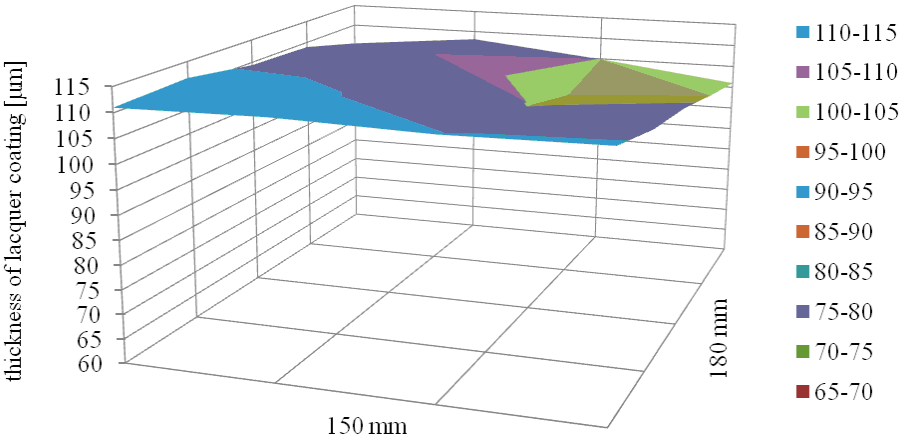

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Fig. 6. Distribution of the thickness of the lacquer coating on a sample of car body sheet after fifth cycle of washing, performed by the instrument KD-Leptoskop 2050

Rys. 6. Rozkład grubości powłoki lakierniczej na próbce blachy karoseryjnej po piątym cyklu mycia wyznaczony za pomocą przyrządu KD-Leptoskop 2050

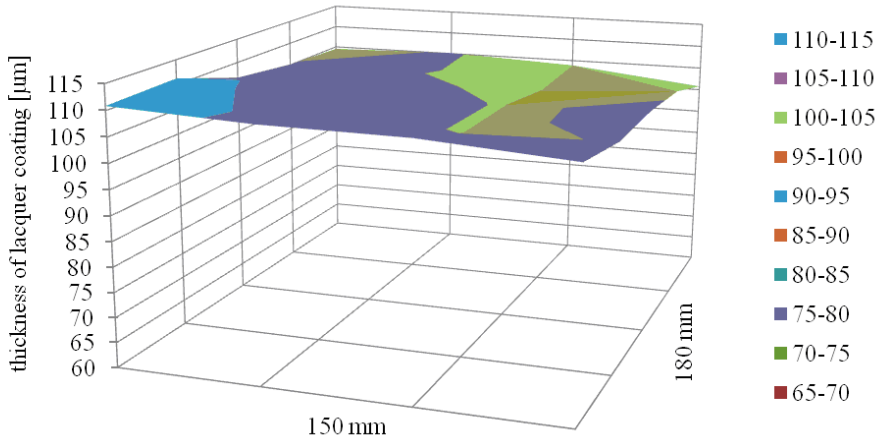

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Fig. 7. Distribution of the thickness of the lacquer coating on a sample of car body sheet after fifth cycle of washing, performed by the instrument MiniTest 730

Rys. 7. Rozkład grubości powłoki lakierniczej na próbce blachy karoseryjnej po piątym cyklu mycia wyznaczony za pomocą przyrządu MiniTest 730

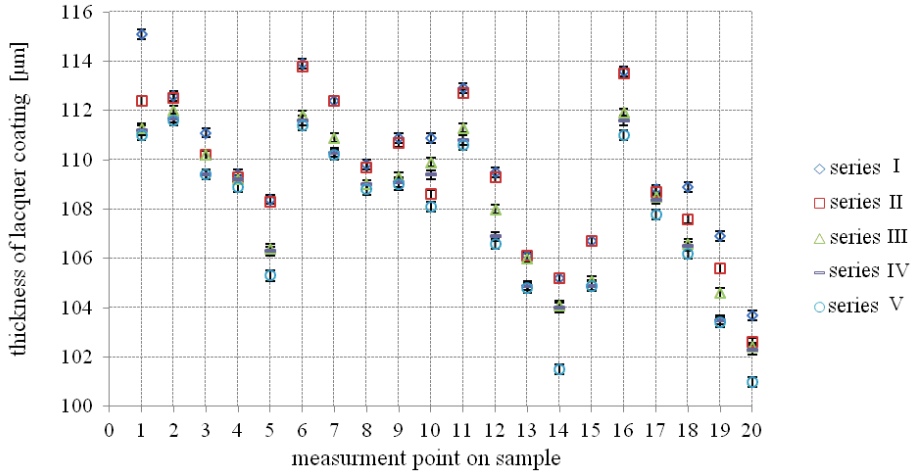

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Fig. 8. Changes in average thickness of the lacquer coating determined by the instrument KD-Leptoskop 2050 for all measuring points in the particular series of measurements

Rys. 8. Zmiany średnich grubości powłoki lakierniczej wyznaczone za pomocą przyrządu KD-Leptoskop 2050 dla wszystkich punktów pomiarowych w poszczególnych seriach pomiarów

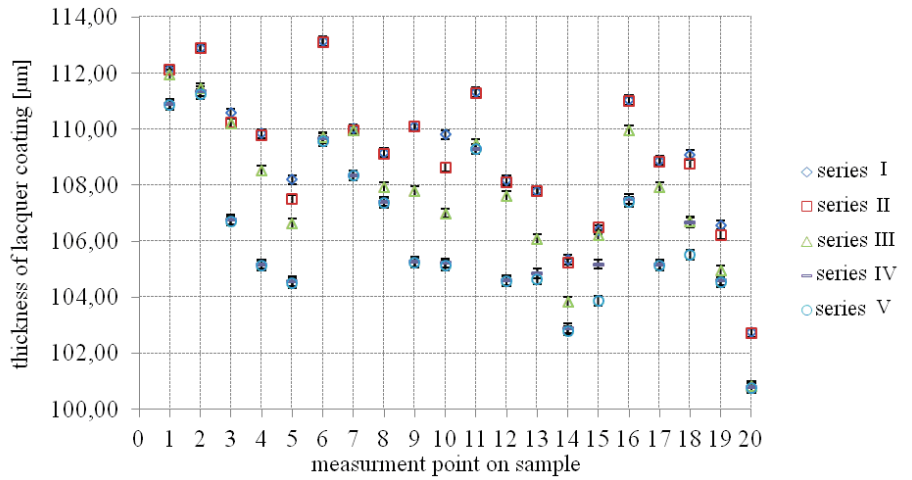

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Fig. 9. Changes in average thickness of the lacquer coating determined by the instrument MiniTest 730 for all measuring points in the particular series of measurements

Rys. 9. Zmiany średnich grubości powłoki lakierniczej wyznaczone za pomocą przyrządu MiniTest 730 dla wszystkich punktów pomiarowych w poszczególnych seriach pomiarów

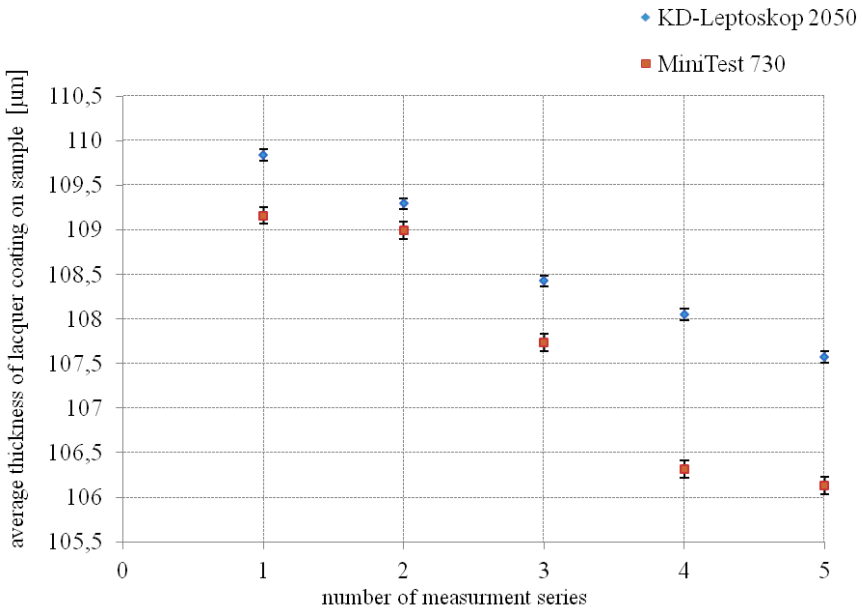

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Fig. 10. A comparison of the average thickness of the lacquer coating determined by using two instruments in each series of measurements

Rys. 10. Zestawienie średnich grubości powłoki lakierniczej wyznaczone za pomocą dwóch przyrządów w poszczególnych seriach pomiarów

Analyzing obtained (Fig. 8 and 9) graphs it should be noted that the greatest loss of coating material occurred at the measurement point number 9 of the sample and amounted to 4.86 µm, which corresponds to 4.4% of the initial coating thickness at this point. The next points in terms of thickness loss of the coating was points 4 and 10 – respectively 4,72 µm (4.3%) and 4.66 µm (4.2%). Points of the sample with the smallest loss of the thickness of the lacquer coating were: point number 1, where the loss of thickness was 1.26 µm, which corresponds to 1.1% of the initial coating thickness, then point 2, where the loss amounted to 1.64 µm (1, 45% of the initial thickness) and point 7, wherein the loss was 1.68 µm i.e. 1.5% of the initial thickness of the lacquer coating. The resulting distributions of lacquer coating thickness obtained with the aid of two independent instruments before washing, during and after manual washing indicate a measurable decrease in the thickness of the lacquer coating on a specially prepared sample. In a better way, the loss of the lacquer coating material while washing illustrates the chart of the changes in average thickness of the coating in individual measuring series, registered after each washing cycles using two measuring instruments (Fig. 10).

5. Conclusions

Based on the investigation results of distribution of lacquer coating thickness carried out on specially prepared sample, contaminated by dust and road dirt and washed manually without pre-washing, the following statements can be formulated:

The washing of lacquered car body, covered by dust and road dirt without the use of pre-washing by rinse using water under low pressure can have a degrading effect on the lacquer coating, expressed by its matt, scratches and the decrease of the insulating properties of the car body against the aggressive vehicle operating environment.

In addition to the deterioration of the aesthetic and functional lacquer coatings a loss of the lacquer was stated. This loss was determined by a decrease in its thickness because of wear while washing, and caused by abrasive components (the most probably silica) contained in the dust and the road dirt, and deposited on means for direct washing (sponge, cloth). The loss can have a different distribution, depending on the method of washing.

The biggest loss of the lacquer coating during subsequent washing steps of the investigated sample were found predominantly in the central area of the sample, which may be due to the higher intensity of manual washing in the middle part of the sample and the greater pressure of the washing means with embedded or loose abrasive.

6. References

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