# RECONDITIONING OF METAL COVERED CAR PARTS

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***Abstract:*** *The research focused on analyzing the mechanical features of the car part surfaces that are about to be reconditioned and on the selection of the proper reconditioning methods and procedures according to the type, dimensions and loadings applied on certain parts of the car body.*

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## 1. Generalities

In order to insure the proper carrying of the experimental research, the following operations were undertaken:

• preparing the parts and a significant number of test tubes made of the same material as the basic parts in order to load them;

• loading the parts by using the metal covering and chroming procedure and carrying out the comparative analysis of the laid-down layers;

• analyzing the workability of the layers in order to decide on the admixture materials required for this particular method and car parts;

• establishing the means of improving the quality of the reconditioned car part surfaces by applying different thermal, thermo-chemical treatments and/or electro-chemical deposition (a duplex procedure);

• assessing the mechanical features of the reconditioned car parts using standardized test tubes loaded under the same conditions;

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• analyzing the thermal and structural influences of the loading processes on the reconditioned parts;

• testing the mechanical and wear and tear endurance of some of the reconditioned parts on the test stand.

The piston pin and the crosshead (figure 1.) function under hard mechanical load conditions. They undergo bending, shock, wear and tear, etc loadings.

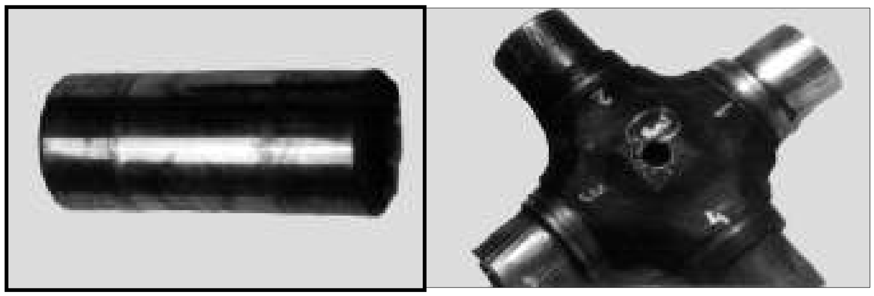

Fig.1. The piston pin and the crosshead

## 2. The preparation of the car parts and the characteristics of the reconditioning technological processes

Preparing the car parts to be loaded by metal covering requires complex operations as it represents the most important operation of the entire reconditioning technological process, the adherence of the laid-down layer practically depending on it.

The operations were carried out according to the provisions and consisted of:

• the mechanical processing, to insure the thickness of the metal covered layer by using the rough turning to restore the part's proper geometrical shape and the necessary space for the admixture material;

• degreasing in order to remove the organic substances from the parts surface by tunnel washing with a jet of ammonia ash solution at a pressure of 0.4 Mpa, followed by a warm water rinsing;

• applying the abrasive cleaning, which was meant to insure a proper roughness and a good adherence of the laid-down material. The abrasive cleaning was made by using Corindon 125 granules with a granulation of 0.5.... 1 mm, entrained by an air flow compressed at 0.3 MPa. After applying the abrasive cleaning, the parts were blown with an air jet in order to remove the dust particles.

In order to improve the adherence, after applying the abrasive cleaning, an intermediary 0.05 mm thick molybdenum layer was laid using S Mo 99, 99 wires with a 1.5 mm diameter. This was placed on the part surfaces by means of thermal spraying, following this displacement method: part's rotative speed 45 rot/min; spraying range 50 mm; spraying angle 45o; wire progress speed 0.2 mm/min (approximately three times lower than when laying the basic layer); continuous laying.

The preparations continued by:

• introducing the wooden plugs in the openings that need to be protected. The height of these plugs over the edge of the openings was 5 mm to insure their adherence to the surface loaded by metal covering;

• protecting the adjacent surfaces by wrapping them with adhesive bands.

Special measures were taken while carrying out the two operations to avoid the contact of the surfaces which are about to be loaded with any organic substances.

## 3. Loading the parts

The process of loading the parts consisted in laying on the surfaces a metallic layer obtained by spraying the melted material with a jet of compressed air in an electric arc.

After wrapping the adjacent surfaces with adhesive band and blowing them with compressed air to remove any remaining particles resulted from the abrasive cleaning, the loading surface was pre-heated with an oxyacetylene flame in order to remove the humidity and bring the surface temperature to an average of 1000C. As far as the hub is concerned, the inner surface temperature after pre-heating reached approximately 150o C.

In order to carry out a comparative study of the layers laid-down by metal covering, two types of wire were used during the experimental researches: S 12 Mo2Si steel wire with a low carbon content and S105 Cr1 (RUL 1) high carbon content wire.

Material laying was carried out in successive layers of about 0.2 mm, with breaks to allow the parts to cool (figure 2).

The quality of the layers laid down by thermal spraying was assessed according to the requirements stipulated by STAS 11684/5-84, as follows:

• hardness assessment;

• adherence was assessed according to the alignment, tracking any potential exfoliations which might have occurred;

• porosity was assessed by using the Everts permeability measurement method

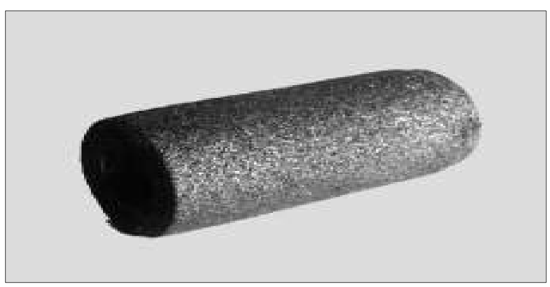

Fig. 2 *The piston pin loaded by metal covering*

The test results are featured in table 1 and in figures 3 and 4.

*Table 1 The quality of the layers laid down by thermal spraying*

| Wire type | Wire diameter | Spraying range [mm] | Measured thickness [HB] | Porosity [%] | Adherence |
|---|---|---|---|---|---|
| S 12Mo2Si | Φ 1,6 | 180 | 155 | 12 | Inadequate |
| | | 150 | 164 | 10 | Inadequate |
| | | 120 | 198 | 7 | Good |
| | | 100 | 202 | 6 | Good |

| | | | | | |
|---|---|---|---|---|---|
| S 105 Cr 1 (RUL 1) | Φ 1,6 | 180 | 352 | 8 | Inadequate |
| | | 150 | 384 | 6 | Good |
| | | 120 | 412 | 5 | Good |
| | | 100 | 418 | 4 | Good |

*Table 2. The depth variation of the physical and mechanical features of the thermally sprayed layer*

| Electrode type | Symbol | Wire diameter | Measurement depth [mm] | Hardnesss [HB] | Porosity [%] |
|---|---|---|---|---|---|
| S 12 Mo2Si | SM 12 Cr 19 | Φ 1,6 | - | - | 13 |
| | | | 0,5 | 161 | 10 |
| | | | 1,0 | 184 | 8 |
| | | | 1,5 | 198 | 7 |
| S 105 Cr 1 (RUL 1) | SM 110 Cr 1 | Φ 1,6 | - | - | 9 |
| | | | 0,5 | 387 | 7 |
| | | | 1,0 | 406 | 6 |
| | | | 1,5 | 418 | 5 |

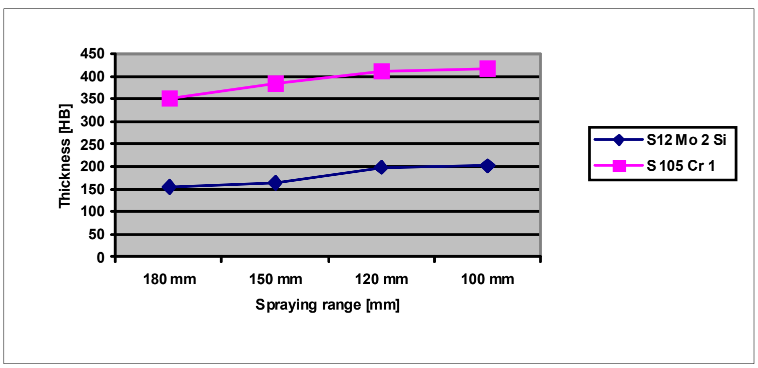


*Fig. 3 Thickness variation in the laid-down layer according to the spraying range*

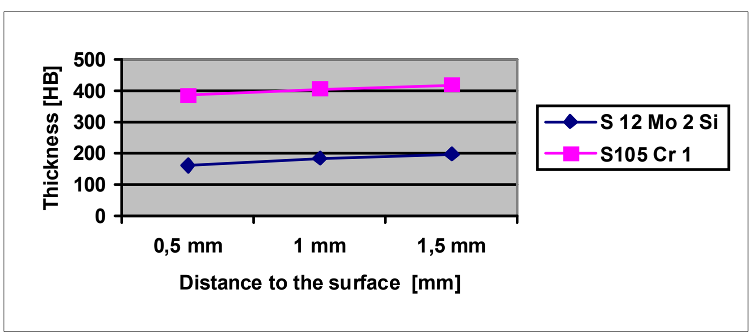


*Fig. 4 Porosity variation in the laid-down layer according to the spraying range*

## 4. Conclusions:

• the laid-down layer has varying porosity and thickness. The deeper we get into the layer thickness, the lower the porosity and the higher the thickness. There can be noticed a constant porosity on all layer's levels, which gives surfaces good friction qualities as far as the fluid friction is concerned, but at the same time it yields the possibility to integrate corrosive particles which may have a destructive influence during the operation. It was also noticed that if the melted metal particles' progress speed is being increased, the porosity drops and the adherence increases. Nevertheless, when excessively increasing the entrainment air pressure, we get the opposite effect, which is considered to be due to high temperature gradients and the high surface particles dispersion.

• the laid-down layer thickness depends on the nature of the material being laid (table 2).

• the adherence of the laid-down layer (if preparations were carried out appropriately) is very good. Apart from the parts which were sprayed within a range of 150...180 mm, there haven't been noticed any exfoliations in the laid-down layer.

• as far as the parts loaded by metal covering are concerned, it is not recommended to apply any thermal treatments which include heating the parts at high temperatures (cementing, hardening) due to the danger of exfoliating the laid-down layer. With these parts good results may be achieved by applying a duplex procedure (metal covering followed by the application of a hard chrome layer), provided there aren't any point like loads which might damage the metal covered layer.

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