Technological bases of use of polymers in case of reconstruction of hydraulic cylinders

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Abstract
Experience of maintenance of hydraulic cylinders is considered. In particular, technologies of reconstruction by means of the modern polymeric materials of hydraulic-cylinder rod with scratches or traces of corrosion, and also clearing of faults of mirror of hydraulic cylinder body or in the form of local damages, multiple scratches and wear scars are developed that requires reconstruction of internal surface of hydraulic cylinder. Many years service of reconstructed rods and bodies of hydraulic cylinders confirmed efficiency of application of new technology and reasonability of its wide use in the industry.
Key words: POLYMERIC MATERIAL, HYDRAULIC-CYLINDER BARREL, ROD, RECONSTRUCTION, REPAIR

Problem statement

In practice of repair production, there often can emerge situations when it is necessary to restore serviceability of hydraulic cylinders obtained different one-time defects or with worn-out surface as a result of operation. From different function hydraulic cylinders repair experience gained by specialists of "Mechanical Equipment of Iron and Steel Works" department of "Pryazovskyi State Technical University", it is possible to emphasize the following defects:

– single scratches on rod;

– multiple scratches on rod;

– local faults of mirror of cylinder, corrosion, compression marks owing to beat;

– uniform wear of mirror with traces of scratches;

– seal damage.

However, there are no effective methods of such defects; and therefore, there is a problem of development of new methods of repair tasks solution due to use of the modern polymeric materials.

Analysis of the latest researches and publications

In each of above-mentioned cases, these or those technologies allowing restoration of serviceability of the hydraulic equipment and considered in papers [1 … 3] can be applied for repairing. However, in one case, the cost of such restoration is rather high and repair can be economically unreasonable, and in another case, it is impossible to restore the initial parameters of hydraulic cylinders to the full extent. Moreover, in certain cases, it is impossible to repair certain defects by traditional methods [4, 5]. At the same time, great experience of application of new technologies using polymers at restoring repair of different equipment was gained by specialists of "Mechanical Equipment of Iron and Steel Works" department of "Pryazovskyi State Technical University" [6, 7].

Objective (tasks) of research

The purpose of this paper is development of new technologies of hydraulic cylinders restoration using polymeric materials.

Basic material of research

Below, stages of elimination of hydraulic cylinders details defects mentioned above are considered sequentially through the example of successful repairs at different industrial enterprises.

First of all, it is necessary to analyze an example of scratches elimination in rod in case if they occur. In case of such defects, it is recommended to restore a rod in the following sequence [8, 9]:

- to heat the rod for the purpose of removing oil which penetrated into micropores of the defective surface;

- to prepare a rod for restoration by means of defect opening by the electric drill with disk cutter of diameter up to 100 mm and thickness of 2… 3 mm. Depth of groove, which will be obtained, should not exceed 1.5 … 3 mm;

- to degrease the processed surface and to apply antifriction material of paste-like consistency such as "Moglays-Hart" of DIAMANT Metallplastic GmbH (Germany);

- to create restorable surface by special pattern;

- after hardening of material, it is necessary to finish this surface by processing by soft abrasive cloth excluding defect of bichromated coating of rod.

Experience of repair of rods with different scratches has confirmed efficiency of such technology inasmuch as repair time period is short, and the expenditure of polymeric material is minimum.

In that case when multiple scratches take place in the section of rod, technology of restoration is reduced to grooving of this section by the lathe tool as shown in Figure 1, application of polymeric material and subsequent mechanical processing of restored section to the required dimensions after its polymerization. Thus, 3 rods of hydraulic cylinders of marine vessel, which had corrosion damages of different sizes along the length, were restored.

The following example concerns local defect of

body mirror of the cylinder which took place due to aggressive medium in working surface and corrosion testimonies of 20×35 mm in size. In this case, the defective section was deepened to 1.2 … 1.5 mm, degreased, and then, restoration was performed by 2 options. The first one consisted in filling of the formed cave by material, and after polymerization, processing by scraping tool to the required level [3]. The second option is shown in Figure 2 and consisted in formation of section of the cylinder mirror by ready-made pattern by means of charging "Moglays-Fl/r" of DIAMANT Metallplastic GmbH into special hole.

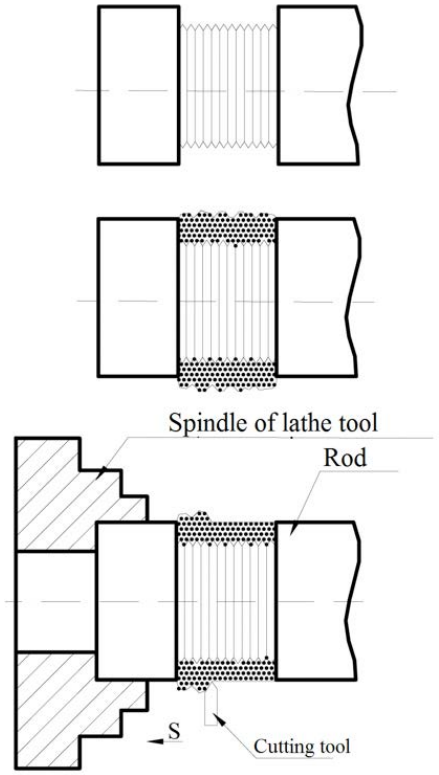

Figure 1. Diagram of restoration of worn-out section of rod: S – direction of feed motion

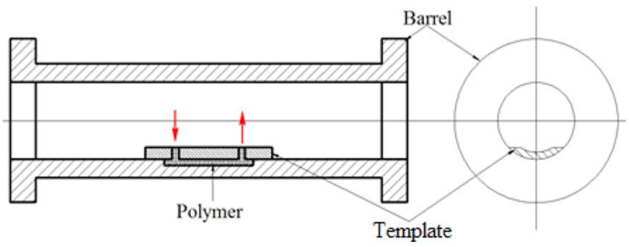

Figure 2. Formation of the defective section by means of templet

The template (see Figure 2) is pressed by clamps to the defective section and the material "Moglays-Fl/r" is charged in special holes by means of syringe. When it appears in control hole, material charging stops. In 16 hours, the template is displaced and demounted.

Thus, it is possible to restore the local defects, and complete or partial recovery of mirror of cylinder body is carried out according to the diagram provided in Figure 3. Stages of implementation of restoration process of 950 mm hydraulic cylinder, which obtained corrosion damage of internal surface, are shown in Figure 4. The basic technological operations include: cylinder groove to 2.5 … 3 mm of diameter, manufacture of template for working surface formation, processing of template by release agent, installation of it in the cylinder and centering, charging of polymeric material from the bottom up by special syringe or standard injection gun used when charging silicone sealers. In 16 hours, the template is taken out, excesses of hardened material are removed and the hydraulic cylinder is ready for operation.

According to the technology described above, restoration of press hydraulic cylinder working at pressure of 300 atm is conducted. Diameter of hydraulic cylinder was 400 mm, and length was 500 mm. The main stages of operation are presented in Figure 5.

Features of repair were that special holes for draw bolts, whereby the template was taken out (see Figure 5), were made in flange of template; and charging of polymeric material was conducted from two opposite points by two injection guns. In case of restoration of hydraulic cylinders, it is necessary to pay special attention to necessity of air bubbles removal from material; they are formed when mixing two components usually by means of stirring mechanism.

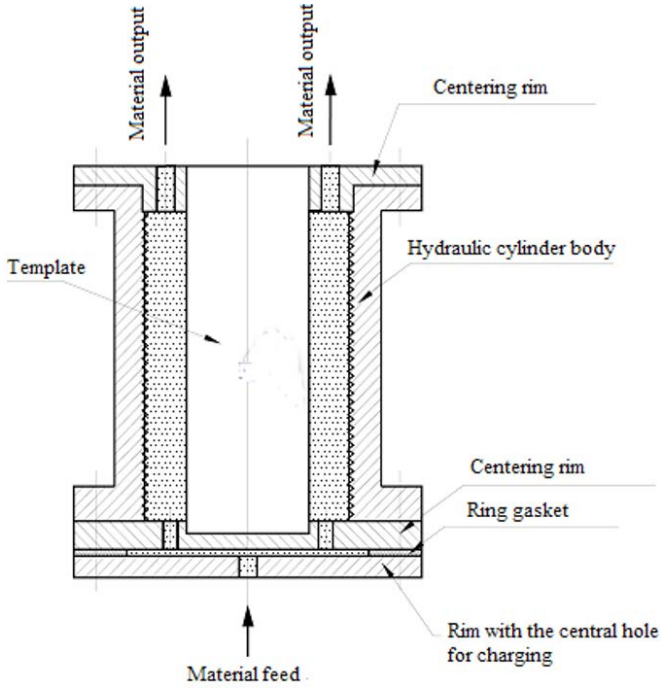

Figure 3. Diagram of restoration of internal surface of barrel of hydraulic cylinder

Figure 4. Stages of restoration of hydraulic cylinder

Figure 5. Stages of restoration of press hydraulic cylinder

Such degassing is conducted by transfer of obtained compound by thin stream from reservoir, where it was mixed, into the syringe or cartridge. Such operation completely excludes probability of emergence of air pockets or small pores on a surface of cylinder. The hydraulic cylinder restored in such way functions more than 5 years without comments relating to any faults.

Conclusions

A series of processing methods allowing restoration of hydraulic cylinders with different defects by means of poly-dimensional materials has been developed. Long-term successful maintenance of restored details of hydraulic cylinders has proved high performance of such type of repairs, when other types of repairs cannot be applied.

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