International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

COPY RIGHT

ELSEVIER
SSRN

IJIEMR Transactions, online available on 12th August 2022.
Link: https://ijiemr.org/downloads/Volume-11/ISSUE-8

DOI: 10.48047/IJIEMR/V11/ISSUE 08/05

Title: **THE INCREASE OF THE SERVICE LIFE OF MACHINE-BUILDING PARTS BY DEVELOPING OF METHODS FOR APPLYING COATINGS WITH A GAS FLAME**

Volume 11, Issue 08, Pages 32-37

Paper Authors: **D.M.Berdiev, A. A. Yusupov, B.K. Abdullaev**

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

THE INCREASE OF THE SERVICE LIFE OF MACHINE-BUILDING PARTS BY DEVELOPING OF METHODS FOR APPLYING COATINGS WITH A GAS FLAME

D.M. Berdiev[1], A. A. Yusupov[2], B.K. Abdullaev[3]
[1]DCs, professor at Tashkent states technical university
[2]PhD, Associate professor at Tashkent states technical university
[3]PhD researcher at Tashkent states technical university

ABSTRACT: In this paper, analysis of the research works related to the increase of the service life of machine-building parts by developing of methods for applying coatings with a gas flame is given. It is known that the production of durable materials takes a lot of time and costs. In many cases, it is required that only the surface part of machinery and agricultural engineering parts, not the whole body, be corrosion-resistant and abrasion-resistant.

Keywords: coating, durable materials, surfacing, electrode, oxidation.

INTRODUCTION

As the mechanical engineering industry develops, the demand for new durable, corrosion-resistant and cheap materials is increasing. It is known that the production of durable materials takes a lot of time and costs. In many cases, it is required that only the surface part of machinery and agricultural engineering parts, not the whole body, be corrosion-resistant and abrasion-resistant. The rapid erosion of their working surfaces is one of the main problems. Several coating methods have been developed for the reinforcement of working surfaces or for the repair of corroded surfaces.

Following types of surfacing are widely used in industry: manual gas-powder surfacing, manual arc surfacing with a consumable electrode, submerged arc surfacing, arc surfacing in shielding gases with consumable and non-consumable electrodes. Despite the low productivity, manual surfacing is the most common in industry. Recently, however, mechanized and automatic surfacing have been increasingly used, which allow increasing the productivity of surfacing by increasing the power of the heating source, reducing the consumption of surfacing materials by reducing spatter losses, reducing oxidation and evaporation of alloying elements, reducing machining allowances, reduce the dependence of the quality of surfacing on the qualifications of workers.

Gas surfacing is surfacing in which a gas flame obtained by burning gaseous products in oxygen is used as a heat source. The gas flame of special burners can be used to weld and spray coatings, as well as to melt them. As a combustible gas, acetylene is most often used, the maximum flame temperature of which in a mixture with oxygen is 2900 ° C, as well as a propane-butane mixture. It can be subdivided into gas surfacing with the addition of rods or wire, gas-powder and flame spraying followed by flashing.

LITERATURE REVIEW

With the help of surfacing, it is possible to obtain layers of any thickness, any chemical composition with various properties (high hardness and wear resistance), antifriction, acid-resistant, heat-resistant layers, etc. on the working surfaces of parts. The mass of deposited metal is usually a few percent of the mass of the entire product. When using structures with deposited wear-resistant layers, a significant increase in the durability of the most loaded machine and mechanism components is achieved.

The following.

Famous scientists such as T.A. Litvinova, D.V. Mogilevsky, N.N. Podrezov, S.N. Egorov, R.V. Pirozhkov, A.G. Grigoryants, A.I. Misyurov, R.S. Tretyakov, A.Ya. Stavertiy worked in this sphere.

The papers [3-4] consider complex metallographic studies of the structure and properties of protective coatings made by the method of gas-powder surfacing (GPN) and supersonic gas-powder surfacing (SGPN). This work is a continuation of research in order to study the ability of the material to resist the impact of abrasive particles. For this, comparative tests of the deposited alloys for resistance to mechanical wear were carried out.
Powdered steel was used as the base material.

Electrocontact sealing (ECS) method. The ECS methodology and laboratory setup are described in. The surfacing material for the samples was used self-fluxing alloy PG-SR3.

The wear of working surfaces necessitates the development of new methods of surface hardening and their practical use, both in the manufacture and in the repair and reconstruction of units and parts of installations. The main problem of surface wear is manifested in the thermal power industry, where the working surfaces of such parts as fluidized bed boilers, superheater pipes, tube plate caps, shutoff valves, etc. are subjected to intense high-temperature gas-abrasive wear.

Saving metal, protecting it from corrosion, increasing the reliability and durability of machines and mechanisms are the most important tasks of all industries, while the correct choice of the method of strengthening, protecting against corrosion and restoring parts is of paramount importance. A promising direction for increasing the service life of products is the formation of a surface layer in contact with the external environment, with improved properties.

To restore worn parts, welding and surfacing methods are mainly used. The disadvantage of these methods are: significant thermal effects on the part, the occurrence of residual stresses, deformations, cracks in the parts and, as a result, a reduction in service life compared to new parts. In addition, the deposited material is characterized by a significant spread of physical and mechanical properties [5].

Electric arc spraying is preferable to other methods of thermal spraying of coatings in terms of such indicators as thermal efficiency, cost of sprayed materials, and ease of maintenance. Electricity consumption per 1 kg of sprayed material during electric arc spraying is approximately 0.6 kW/kg. During plasma spraying, energy costs are 5–7 kW/kg for powder spraying, 2–3 kW/kg for wire spraying [6]. Feasibility study carried out by Y.A. Kharlamov showed that the relative cost of electric arc coatings is 3–10 times cheaper than coatings obtained by other methods of thermal spraying while ensuring their high strength [7].

In many branches of mechanical engineering, the issue of restoring large-sized parts affected by a corrosive environment in conjunction with mechanical loads is an acute issue. At present, such parts are traditionally restored by plasma or electric arc surfacing, although the properties of coatings obtained by such methods are often significantly lower than the properties of the applied materials. Laser cladding is an actively developed method of restoration, the economic efficiency of the process has been proven by a number of successful examples. However, the properties of coatings obtained by laser cladding are little studied and do not allow predicting the results of using one or another composition of the filler powder.

Stainless steels of both martensitic and austenitic classes are widely used in mechanical engineering [8]. Due to the relatively high cost, the manufacture of parts entirely from these steels is not economically viable. In this regard, the creation of parts from low-carbon low-alloy steels with coatings from steels with improved performance is promising task of modern machine-building production. Such coatings can be used both to increase the resource of new parts, and to renovate units with a simultaneous increase in their resource to the level of the original and above [9].

An analysis of the metal structure at magnifications of 500 and 1000 times shows that the surface layer mainly consists of martensite grains of different morphology with precipitates of intermetallic phases along the grain boundaries. In the central part of a single heating zone, ferrite grains have an asymmetric shape, elongated in the direction of growth of a dendritic crystal with an axes ratio of 5-7 μm by 15-20 μm. Intermetallic phases are isolated in the form of spherical particles with an average size of 1-3 microns. In the overlap zone of individual passages, subjected to reheating, martensite grains have a size of up to 10 μm. Precipitation of intermetallic phases is less noticeable (Fig. 1).

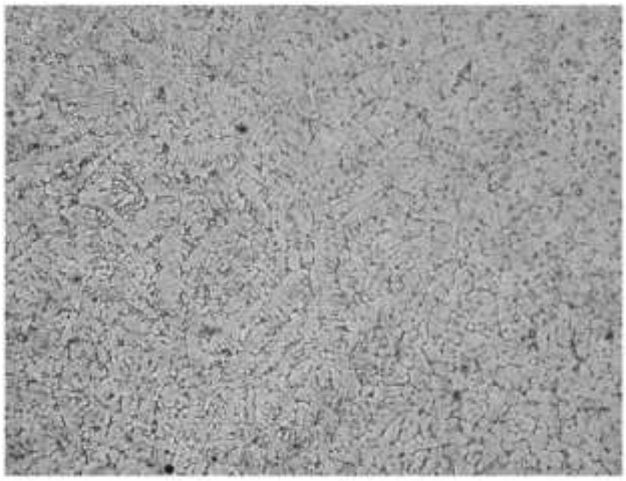

Fig. 1. Microstructure of a longitudinal section of the surface layer of steel 40X13 (500 times)

As a result of the research, it was found that austenitic steel after application by a continuous fiber laser without special measures is soft and unstable to wear. However, the corrosion resistance of this steel is high. In addition, due to the high content of nickel and chromium, it is known that steel can withstand temperatures up to 500 degrees without creep, which can ensure its applicability in the creation of protective heat-resistant coatings on unloaded parts. Steel 40X13 works well under conditions of increased mechanical loads with dry friction and the presence of abrasive wear.

CONCLUSION

Gas-powder surfacing has proven itself well in correcting defects in iron castings. Gas-powder surfacing is used to restore and harden flat parts, as well as parts of complex geometric shapes. Gas-powder surfacing is carried out with special surfacing torches such as GN-2, GN-5P, MST-100. Dissolved acetylene in cylinders

(GOST 5457-75), technical liquefied propane-butane (GOST 20488-88) and oxygen (GOST 9293-74) are used as working gases in gas-powder surfacing. It is recommended to use self-fluxing powder alloys based on nickel, cobalt and iron as materials. The material for a specific part is selected taking into account the conditions of its operation and the required hardness of the restored surface.

REFERENCES:

1. Abralov M.A., Abralov M.M. Payvandlash ishi asoslari. Tashkent: Talkin, 2004.
2. Bykov V.V., Faizulina T.S. Gas burners. M.: Mashinostroenie, 1974
3. Litvinova, T.A. et al. Metallographic studies of the structure of protective coatings made by the method of gas-powder surfacing [Electronic resource] / T.A. Litvinova, D.V. Mogilevsky, N.N. Podrezov, S.N. Egorov, R.V. Pirozhkov // Engineering Bulletin of the Don: network journal. - 2014. - No. 3. – Access mode: URL: ivdon.ru/ru/magazine/archive/n3y2014/2454 – 03/10/2016.
4. Litvinova, T.A. et al. Investigation of the structure of protective coatings made by the method of supersonic gas-powder surfacing [Text] / T.A. Litvinova, D.V. Mogilevsky, E.I. Kolokolov, A.A. Metzler, N.N. Podrezov // Global Nuclear Safety. - 2014. - No. 3 (12). – P. 61–64.
5. Umarov, E., Mardonov, U., Abdirakhmonov, K., Eshkulov, A., & Rakhmatov, B. (2021). Effect of magnetic field on the physical and chemical properties of flowing lubricating cooling liquids used in the manufacturing process. *IIUM Engineering Journal*, *22*(2), 327-338.
6. Pashchenko V.N., Fen E.K.: Restoration of parts of transport equipment by the method of electric arc spraying // Welder. - 2005. - No. 3. - P. 16 - 18.6. Korobov Yu.S.: Efficiency of using activated arc metallization for applying protective coatings // Welding production. -2005. - No. 2. - S. 47 - 50.
7. Odilov, E., & Mardonov, U. (2021). Effect of Magnetic Field on the Properties of Flowing Lubricating Cooling Liquids used in Manufacturing Process. *International Journal on Orange Technologies*, *3*(12), 1-5.
8. Korobov Yu.S., Lukanin V.L. Pryadko A.S., Izoitko V.L.: The advantage of activated arc metallization // Welder. - 2002. - No. 2. - P. 16.
9. Materials Science: Textbook for higher technical educational institutions. B.N. Arzamasov, I.I. Sidorin., G.F. Kosolapov. M.: Mashinostroenie, 1986. - 384 p., ill.
10. Grigoryants A.G., Shiganov I.N., Misyurov A.I. Technological processes of laser processing: Proc. allowance for universities / Ed. A.G. Grigoryants. - M .: Publishing house of MSTU im. N.E. Bauman, 2006. - 664 p.: ill.
11. Musin, R. A. Special methods of pressure welding: textbook /R. A. Musin, G. V. Konyushkov. - Saratov: IP Air Media, 2009. - 696 p.
12. Special methods of welding and soldering / Ed. V. A. Frolova. - Moscow: Intermet engineering, 2003. - 184 p.
13. Berezienko, V.P. Pressure welding technology: textbook /V. P. Berezienko, S. F. Melnikov, S. M. Furmanov. - Mogilev: Belorus.-Ros. un-t, 2009. - 256 p.
14. Sosnin, N. A. Plasma technologies. A guide for engineers / N. A. Sosnin, S. A. Ermakov, P. A. Topolyansky. - St. Petersburg:

Polytechnic. un-t, 2013. - 406 p.