IJIAET International Journal of Innovative Analyses and Emerging Technology

| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 2 Issue: 2

Gas Thermal and Galvanic Coatings on the Surface of Parts

S. B.Yulchieva

Candidate of Technical Sciences, Senior Researcher, SUE "Fan vatarakkiyot", Tashkent state technical university, Republic of Uzbekistan, Tashkent

Sh.G‘. Rubidinov, J. G‘.Gayratov

Assistant of the Department of Mechanical Engineering and Automation, Fergana polytechnic institute, Fergana, Uzbekistan

Anvar Olimov, Muhammad yusuf Yunusov

Student of Fergana polytechnic institute, Republic of Uzbekistan, Fergana

Abstract: This article discusses the use of gas-thermal and galvanic coating methods for restoring the working surfaces of parts, their effect on the surface layer and efficiency.

Keywords: aluminum, titanium, chromium, gas-thermal coatings, galvanic coatings, laser method, chemical-thermal methods.

Part of the gas-thermal methods - gas-flame and electric arc metallization - is well known and widely used. Plasma and detonation coatings are one of the most promising areas of powder metallurgy. The resistance to wear and corrosion of parts made of conventional structural materials can be increased many times over with a small consumption of powder materials.

In plasma coating, the material is melted and sprayed with a low-temperature arc plasma jet consisting of electrons, positive ions, and neutral atoms. The ionized gas flow is characterized by high temperatures (5000-10000°C) relatively low velocities (up to 250-600 m/s). The most commonly used working gas is argon. Since the plasma jet entrains air, oxygen-active materials are deposited in chambers that are preliminarily filled with an inert gas. Other methods of applying coatings in a "dynamic" vacuum have also been developed.

Plasma coatings have a complex arched structure. The porosity of the coatings ranges from 2-15%. Plasma methods can be used to apply coatings from almost all materials. Clad powders make it possible to include in the composition of coatings even materials that are not sufficiently stable upon heating (for example, $MoS2$).

The high temperature and energy of the plasma make it possible to successfully use the plasma method for the deposition of coatings from all refractory materials (with the exception of subliming and rapidly decomposing at the deposition temperature), which are characterized by high binding energy in the crystal lattice and, as a result, high hardness. The applied coatings are characterized by high wear resistance (table 1).

Table 1 Relative wear resistance of plasma coatings (at abrasion on a sanding sheet for 1 min. at a sliding speed of 8 m/s and a pressure of 1.7 MPa)

Coating material	Wear, mg	Wear, mg
Steel:		
low carbon, molybdenum alloyed	900	1
corrosion resistant	711	1,27
chrome-molybdenum	509	1,77
Satellite:		
№ 66	486	1,85
№ 33	289	3,11
№ 11	66,3	13,57
Koloona:		
№ 4	142,1	6,33
№ 5	111,3	8,09
№ 6	35,5	25,35

With the detonation method of coating, a portion of the gas mixture capable of detonating upon ignition and a portion of the powder of the applied material are fed through the mixer into the channel of the barrel open at one end through the mixer. With the help of an ignition device, an explosion of the gas mixture is initiated. The sprayed material is heated, accelerated and ejected to the surface of the part. As a result of the explosion of a mixture of combustible gas (usually acetylene) and oxygen, particles of the sprayed material introduced into the gas are heated (not higher than 2850 ° C) and accelerate to very high speeds (up to about 1000 m/s). When particles with high kinetic energy hit a solid surface, a large amount of heat is released, and their temperature can reach 4000°C.

The plasma method provides heating of particles to higher temperatures than the detonation method. The temperature limitations in the detonation method of coating are compensated by the higher kinetic energy of the particles, which makes it possible to apply refractory materials as well. Due to the high velocities of the sprayed particles, detonation coatings have a higher density (98-99%) and adhesion strength to the base compared to plasma and, moreover, conventional gas-flame coatings. A significant advantage of the detonation method in comparison with the gas-flame and plasma is its discreteness, and as a result, the lower heat density. The heating of the workpiece during the spraying process may not exceed 200°C.

The detonation method has mastered the application of coatings of the most diverse composition: hard-alloy coatings using various carbides (tungsten, chromium) and binders (Co, Ni, Ni + Cr); oxide (from oxides of aluminum, titanium and chromium), metal. This makes it possible to repeatedly increase the wear resistance of machine parts and tools.

Detonation coatings have found wide application abroad, especially in aviation.

The application of detonation coatings makes it possible to repeatedly increase the wear resistance of machine parts.

Laser methods of modification and alloying of surface layers. Significant opportunities for improving the wear resistance of surfaces appeared with the development of industrial lasers. Due to the high energy density in the laser beam (up to 109 W/cm2), it is possible to rapidly heat a thin surface layer of metal, up to its melting. The subsequent rapid removal of heat into the bulk of the metal leads to hardening of the surface layer with high hardness and wear resistance (the processes occurring in the surface layer and, consequently, its properties are determined by the power and duration of the laser beam). It is also possible to carry out alloying of the surface layer by preliminary deposition of a layer

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

IJIAET International Journal of Innovative Analyses and Emerging Technology

| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 2 Issue: 2

of the alloying component on the surface in some way, followed by melting by the laser beam, and also to apply coatings by introducing the powder of the deposited material into the laser beam. Quite a lot of experience has been accumulated in laser hardening of parts made of steel and cast iron.

Electro spark coatings. The electro spark alloying method is based on the transfer of the electrode material (mainly the anode material) during a pulsed spark discharge in a gaseous medium onto the surface to be treated. Vibrating electrodes are used to apply electro spark coatings. In Bulgaria, a method of hardening with a rotating electrode was developed.

When applying metal coatings, the base material retains its original phase composition. When doping with compounds (metal-like), as a rule, chemical interaction with the base material occurs with the formation of chemical compounds of the elements included in the applied material with the base elements. The application of electro spark coatings significantly increases the wear resistance and antifriction properties of surfaces.

With hydro abrasive wear as a result of electro spark alloying, the wear resistance of steels increases significantly. The heat resistance of surfaces after electro sparks alloying also increases significantly.

The areas of expedient application of electro spark alloying are quite diverse. However, the discreteness and porosity of the coatings, small thickness, low productivity, high roughness of the treated surfaces, residual tensile stresses that prevent their widespread implementation.

Electro spark alloying is used to increase the reliability of machine parts, instruments and mechanisms of tools (cutting and deforming), molds for casting metals, and for dimensional restoration of machine parts.

Galvanic methods can be used to apply coatings from metals, alloys and composite materials.

The introduction of particles of other materials (CEP) into the composition of coatings based on chromium, iron and nickel significantly increases their tribological properties. The introduction of powders of carbides, oxides, borides, diamond, etc., can significantly increase the wear resistance of coatings; introduction of chalcogenides, graphite, polymers – antifriction coatings. The technology of electrolytic deposition makes it possible to obtain coatings with a particle content of up to 40% and a thickness of up to 100 microns.

Carbides (WC, TiC, ZrC, HfC, SiC, B4C), borides (TiB2, ZrB2, HfB2, TaB2), silicates (TaSi2), nitrides (BN, Si3N4), oxides (Al2O3, Cr2O3, SiO2, ZrO2 , ThO2), sulfides (MoS2, WS2).

With the simultaneous introduction of particles with high hardness and solid lubricant particles into the coating, wear resistance and antifriction properties increase. Nickel-based composite coatings have the best tribological properties. The values of the friction coefficient significantly decrease when even a small amount of solid lubricant (about 1% MoS2) is introduced into the coating composition.

Chemical-thermal methods for modifying the surface layers of metals and alloys combine simultaneous thermal and chemical effects in order to change the chemical composition, structure and properties of the surface layer. They are carried out as a result of diffusion saturation of a metal or alloy with non-metals C, N. B, Si, etc. or with metals Al, Cr, Zn, etc. (separately and in a number of methods jointly) in a certain temperature range in an active (or specially activated) environment.

Carburizing (carburization), nitro carburizing (cyanidation, carbonitration) and nit riding are widely used to increase wear resistance in the durability of steel parts. To a lesser extent, use saturation with boron and silicon, also with metals (Cr, Al, etc.). The choice of one or another method of saturation of the diffusing element (elements) is carried out taking into account the requirements for the properties

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

of the modified surface, the type of production, the dimensions of the workpieces, the required thickness of the resulting layer, etc.

Literature

1. Qosimova, Z. M. (2021). Influence of The Design of The Rolling Roller on The Quality of The Surface Layer During Plastic Deformation on the Workpiece.
2. Fayzimatov, S., &Rubidinov, S. (2021). Determination of the bending stiffness of thin-walled shafts by the experimental methodological method due to the formation of internal stresses. *InternationalEngineeringJournalForResearch&Development*, *6*(2), 5-5.
3. Nomanjonov, S., Rustamov, M., Rubidinov, S., &Akramov, M. (2019). STAMP DESIGN. *Экономика и социум*, (12), 101-104.
4. Юлчиева, С. Б. Мухамедбаева, З. А., Негматова, К. С., Мадаминов, Б. М., &Рубидинов, Ш. Г. У. (2021). Изучение физико-химических свойств порфиритовых жидкостекольных композиций в агрессивной среде. *Universum: технические науки*, (8-1 (89)), 90-94.
5. Юлчиева, С. Б. Негматов, С. С., Негматова, К. С., Мамуров, Э. Т., Мадаминов, Б. М., &Рубидинов, Ш. Г. У. (2021). ПОВЫШЕНИЕ КОРРОЗИОННОСТОЙКОСТИ КОМПОЗИЦИОННЫХ МАТЕРИАЛОВ С ДОБАВЛЕНИЕМ ПОЛИМЕРНЫХ ДОБАВОК. *Universum: технические науки*, (10-1 (91)), 48-52.
6. Рубидинов, Ш. Ғ. Ў. (2021). Бикрлиги паст валларгасовуқишловберишусули. *Scientificprogress*, *1*(6), 413-417.
7. Тешабоев, А. Э. Рубидинов, Ш. Ғ. Ў., Назаров, А. Ғ. Ў., &Ғайратов, Ж. Ғ. Ў. (2021). Машинасозликда юза тозалигининазоратиниавтоматлаш. *Scientificprogress*, *1*(5).
8. Рубидинов, Ш. Ғ. У. &Раимжонов, Қ. Р. Ў. (2022). ИЗМЕНЕНИЕ МИКРОРЕЛЬЕФА ПОВЕРХНОСТИ И ШЕРОХОВАТОСТИ ДОПУСКОВ ДЕТАЛЕЙ ПОСЛЕ ХИМИЧКЕ-ТЕРМИЧЕСКИЙ ОБРАБОТКИ БОРИРОВАНИЯ. *Scientificprogress*, *3*(1), 34-40.
9. Рубидинов, Ш. Ғ. У., Ғайратов, Ж. Ғ. У., &Райимжонов, Қ. Р. Ў. (2021). ИЗНОСОСТОЙКИЕ МЕТАЛЛОПОДОБНЫЕ СОЕДИНЕНИЯ. *Scientificprogress*, *2*(8), 441-448.
10. Рубидинов, Ш. Г. У. &Ғайратов, Ж. Г. У. (2021). Кўпоперациялифрезалабишловберишмарказинингтанадеталларигаишловберишдагиунумдорлигинитахлили. *Orientalrenaissance: Innovative, educational, naturalandsocialsciences*, *1*(9), 759-765.
11. Рубидинов, Ш. Ғ. У. Қосимова, З. М., Ғайратов, Ж. Ғ. У., &Акрамов, М. М. Ў. (2022). МАТЕРИАЛЫ ТРИБОТЕХНИЧЕСКОГО НАЗНАЧЕНИЯ ЭРОЗИОННЫЙ ИЗНОС. *Scientificprogress*, *3*(1), 480-486.
12. угли Ғайратов, Ж. Г. (2021). Влияние Роликовой Конструкции На Качество Поверхностного Слоя Цилиндрической Конструкции При Деформации. *БарқарорликваЕтакчиТадқиқотлар онлайн илмийжурнали*, *1*(6), 502-511.
13. Рубидинов, Ш. Ғ. Ў., & Акбаров, К. И. Ў. (2021). Машинасозликдасочилувчанматериалларниташишда транспортер тизимларинингаҳамияти. *Scientificprogress*, *2*(2), 182-187.
14. Рубидинов, Ш. Ғ. Ў., &Ғайратов, Ж. Ғ. Ў. (2021). Штампларнитаъмирлашдазамонавий технология хромлашусулиданфойдаланиш. *Scientificprogress*, *2*(5), 469-473.

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

15. Мадаминов, Б. М., Юлчиева, С. Б., Негматова, К. С., Кучкаров, У. К., Рубидинов, Ш. Г., &Негматов, С. С. АНТИКОРРОЗИОНАЯ ПОРФИРИТОВАЯ КОМПОЗИЦИЯ С УПРОЧНЕННОЙ СТРУКТУРОЙ ДЛЯ ЗАЩИТЫ ОБОРУДОВАНИЙ ХИМИЧЕСКОЙ ПРОМЫШЛЕННОСТИ. *ompozitsion*, 43.
16. Қосимова, З., Акрамов, М., Рубидинов, Ш., Омонов, А., Олимов, А., & Юнусов, М. (2021). ТОЧНОСТЬИЗГОТОВЛЕНИЯПОРШНЕЙВЗАВИСИМОСТИОТВЫБОРАЗАГОТОВКИ. *Oriental renaissance: Innovative, educational, natural and social sciences*, *1*(11), 418-426.
17. Мадаминов, Б. М., Юлчиева, С. Б., Негматова, К. С., Кучкаров, У. К., Рубидинов, Ш. Г. У., Негматов, С. С., ... &Мамуров, Э. Т. (2021). АНТИКОРРОЗИОННЫЕ КОМПОЗИЦИОННЫЕ СИЛИКАТНЫЕ МАТЕРИАЛЫ ДЛЯ ЗАЩИТЫ ОБОРУДОВАНИЙ ХИМИЧЕСКОЙ ПРОМЫШЛЕННОСТИ. *Universum: технические науки*, (10-3 (91)), 61-66.
18. Тураев, Т. Т., Топволдиев, А. А., Рубидинов, Ш. Ғ., &Жайратов, Ж. Ғ. (2021). ПАРАМЕТРЫИХАРАКТЕРИСТИКИШЕРОХОВАТОСТИПОВЕРХНОСТИ. *Oriental renaissance: Innovative, educational, natural and social sciences*, *1*(11), 124-132.
19. Akramov, M., Rubidinov, S., &Dumanov, R. (2021). METALL YUZASINI KOROZIYABARDOSH QOPLAMALAR BILAN QOPLASHDA KIMYOVIY-TERMIK ISHLOV BERISH AHAMIYATI. *Orientalrenaissance: Innovative, educational, naturalandsocialsciences*, *1*(10), 494-501.
20. Medatovna, K. Z., &Igorevich, D. D. (2021). Welding Equipment Modernization. *International Journal of Human Computing Studies*, *3*(3), 10-13.
21. Turakhodjaev, N., Akramov, M., Turakhujaeva, S., Tursunbaev, S., Turakhujaeva, A., &Kamalov, J. (2021). Calculation of the heat exchange process for geometric parameters. *International Journal of Mechatronics and Applied Mechanics*, (9), 90-95.
22. Gaynazarov, A. T., &Rayimjonovich, A. R. (2021). ТЕОРЕТИЧЕСКИЕ ОСНОВЫ РАЗРАБОТКИ КЛЕЯ В ПРОЦЕССЕ СВАРКИ НА ОСНОВЕ ЭПОКСИДНОГО СПЛАВА ДЛЯ РЕМОНТА РЕЗЕРВУАРОВ РАДИАТОРА. *Orientalrenaissance: Innovative, educational, naturalandsocialsciences*, *1*(10), 659-670.
23. Таджибаев, Р. К., Гайназаров, А. А., & Турсунов, Ш. Т. (2021). Причины Образования Мелких (Точечных) Оптических Искажений На Ветровых Стеклах И Метод Их Устранения. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *2*(11), 168-177.
24. Рустамов, М. А. (2021). Методы термической обработки для повышения прочности зубчатых колес. *Scientificprogress*, *2*(6), 721-728.
25. Юсуфжонов, О. Ғ. &Ғайратов, Ж. Ғ. (2021). Штамплашжараёнидаишчиюзаларниейилишгабардошлилигиниоширишдамойлашниаҳамияти. *Scientificprogress*, *1*(6), 962-966.

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022