IMPROVING THE STRENGTH OF DETAILS BY CHROMING THE SURFACES

Khusanboyev A.M
(Fargona Polytechnic Institute)

Mukhtorov SH.S
(Fargona Polytechnic Institute)

ABSTRACT

Development of an optimal option of electrolytic growth and plasma coating methods to improve the chromium strength of the surface of the parts and analysis of scientific and theoretical, practical confirmation of the solution.

Keywords: Galvanic plating, chrome plating, plasma.

Research has shown that we have analyzed several different methods to extend and repair the life of the working part of the stamps, and considered the methods of chromium plating, steel, electrolytic growth and plasma liquefaction as the optimal option, and scientific research has been conducted on these methods.

Galvanic coating is based on the property of the separation of metals from a solution of metal salts under the influence of an electric current. When the detail is connected to the negative pole of the current source - the cathode, the metal sits on its cracked surface.

The anode connected to the positive pole of the current source serves as the second electrode. Both electrodes are placed in a solution of detachable metal salts (Fig. 1). Galvanic and chemical coatings are applied to fill the cracked surface of the part, and are also used to remove corrosion-resistant or decorative coatings from them.

Galvanic plating methods include chromium plating, iron plating, nickel plating, galvanizing and copper plating, while chemical plating plating methods includeoxidation and phosphating.

Galvanic coatings are obtained from electrolytes formed from an aqueous solution of the parts to be deposited on the part. When a current flows through the electrolyte, the cathode (detail) sits on the metal and the anode melts. When removing the coating in this way, the part does not heat up much and it is possible to restore the worn parts to the nominal size. Chrome plating is used to restore and protect against corrosion of worn parts up to 0.25 ... 0.30 mm. Chrome coatings are blue - white in color and the hardness of the coating is NV (according to Brinell) 800 -1000 - their resistance to corrosion and corrosion is great. The service life of the parts coated in this way

increases by 4 ... 10 times depending on the operating conditions. Chrome plating can be transferred to chrome and refined steels. The electrochemical (galvanic) recovery method is based on Faraday's law. The hardness of the chromium coating is HV (according to Vickers) 1200, and that of the zinc coating is 50-70 HV. Repair plants often use galvanic chromium plating and steel (forging), and to a lesser extent - nickel plating, copper and zinc plating (galvanizing). The reaction produces chromic acid (H2CrO4). CrO3 H2O = H2CrO4. , The coating process begins when a current is applied to this solution. However, in order to ensure the quality of the chromium process, this solution is again added (H2SO4). Their ratio is obtained as follows.

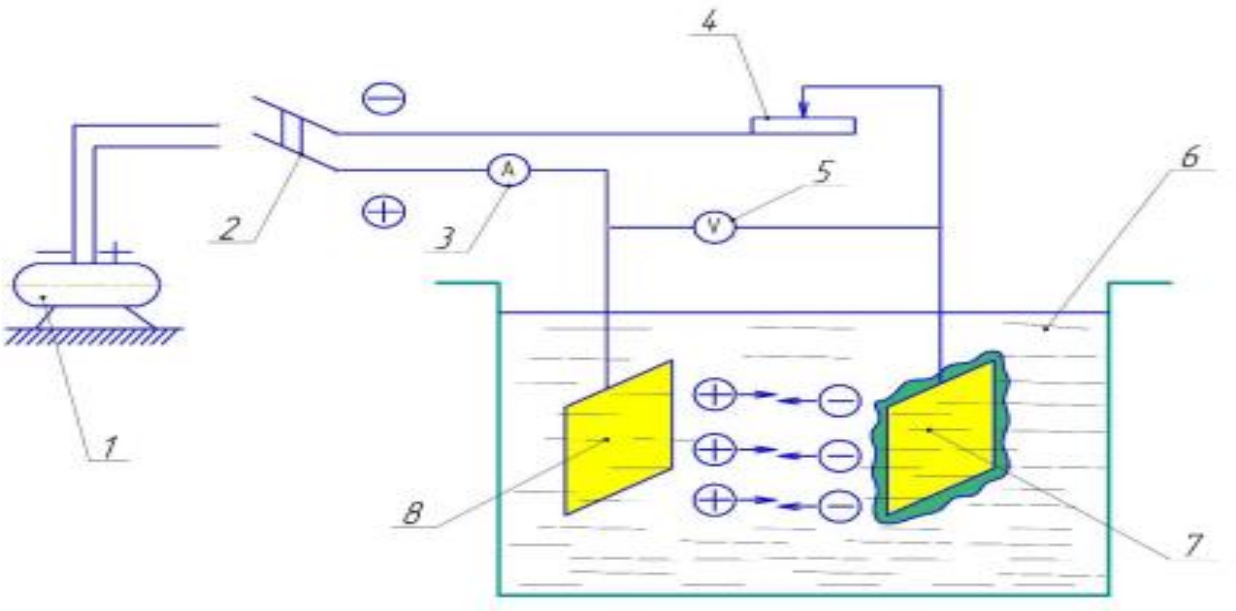

Figure 1: Schematic view of the electrolysis process: anions; -cations;

CrO3 H2SO4 distilled water; FA (2… 2.5)> Fk FA, Fk is the ratio of anode and cathode surfaces; H2SO4 - Sulfuric acid CrO3 - chromium anhydride.

Detail - cathode (-) plate - anode () (lead and lead).

1 - current source; 2 - switch (separator); 3.5 - ammeter and voltmeter; 4 - rheostat; 6 - galvanic soluble metal salt; 7 - cathode plate (recoverable detail); 8 - anode plate (soluble plate).

CrO3 90 in the ratio of H2SO4 125. In this case, the amount of current output is 13 ... 15%, the hydrogen (H2) released during electrolysis is partially dissolved in the chromium coating. Oxygen (O2) is released from the anode (lead plate) and dissolves in water as a result. In order for the solution to retain the amount of insoluble lead in the experiment (5 ... 20g / l), the surface must be made 1.5 ... 2 times larger than the surface of the cathode plate. Faraday's law can be expressed by the following formula: Qn = c × I × T, grams, where Qn is the amount of metal released during electrolysis, grams; S - electrochemical equivalent g / a * hour; I - current, A; T - electrolysis process time, hours. Output value on the first side:

$$Q1(x) = c \times \left(\frac{I \times T}{1000}\right) \times \eta, \quad \text{grams;}$$

$$\eta = \frac{Qx}{QH} \times 100\%,$$

where Qx, QH - the actual and theoretical calculated output on the vine, grams; ē-FIK (efficiency of hydrolysis process):

ēchrome = 15… 20%; ēFe = 85… 90%. On the other hand, knowing the parameters F, h and g at the cathode, the output value of the current: Q2 (x) = F × h × g, gram where F is the surface to be covered, cm2; h - average coverage of the coating, cm; g is the relative mass density of the coated metal, g / cm3. In that case,

Q1(x) = Q2(x) Using the equation, the time spent on the chromium process can be determined as follows:

C × I × T × η 1000 = F × h × γ

From this h = γ×h 1000×F×γ ×c × I × T ×η = c × DK × T ×η/1000 × γ, см Ёки T=(1000F×h/c×I×η) ×ρ, соат [(1дм=1000мм)]. , We determine the diffusion capacity of the amount of chromium released as follows: where, K is the coefficient taking into account the ratio of the distance between the cathode and the anode; M is a coefficient that takes into account the ratio of the amount of metal deposited on the near and far cathode. In places with sharp edges, bubbles, the current is high, the coating process is accelerated, in low and sunken places it is the opposite, the metal does not sink less. Decopying methods are used to stabilize the coating residue. To obtain a quality chrome plating, it is recommended to:

1) Clean the details from dirt, rust and mats, wash in a hot alkaline solution bath. Clean rust with a scraper skin or steel brush. 2) Recoverable details are sanded first.

3) The detail size is controlled (to give a precise coating), taking into account the machining flow.

4) Insulation of areas that do not need chromium plating, including suspensions (should be coated with a solution of celluloid in acetone, 9 -32 varnish, AK -20, and 2 -6 layers of Bf adhesives).

5) Hanging of reversible details on suspensions, use of shielding means.

6) Degreasing, otherwise chromium particles may not adhere well (washing with benzine, lubrication with intravenous lime, chemical degreasing; Electrolytic degreasing liquid glass; (t = 70… 750 s) -5 ... 8 min; U = 8… 10 V hot water solution contains 30 ... 50 g / l edky sodium 50 ... 75 g / l calcium soda, 2 ... 5 g / l.

7) Anode decoding (this helps to separate the oxide film). Current density Dk = 30 ... 35 A / dm2 is processed for 30 ... 45 seconds (this method is called decoupage method). Sometimes chemical decoding is used instead of anode decoding. The part, together with the suspension, is immersed in 5% seric acid for 10 seconds to 1 minute.

In the previous method, the coated part is rinsed with clean water, and in the last method, it is washed in distilled water.

8) Carry out the chromium plating process. Depending on the temperature and density of the electrolyte, three types of chromium plating can be obtained: A. Obtaining a gray chrome plating. It has a very high hardness of 900 -1200 HV, but they are much more brittle, break easily, this method of coating is not used in the restoration of parts, they are difficult to mechanically process. B. Obtaining a polished (glossy) chrome coating, equal to 600 ... 900 HV, with low corrosion resistance. The fragility is low, but does not allow to restore the details, they are effective in the work of decoration, jewelry. C. Getting a milk-colored chrome coating (400 ... 600 HV) - they have sufficient plastic properties, are easy to machine and wear-resistant. In this way, the former vertical spindles, spools, plungers were chrome-plated. In agriculture, worn-out details are restored. This method is widely used.

9) Control of restored details, color, coating - these are the main parameters.

10) Remove the parts from the hanger and rinse them in clean water.

11) Heat treatment of details (as mentioned, the chromium coating absorbs hydrogen, the amount of hydrogen in the coating plays a major role in making them brittle.

12) Coated parts are machined to nominal or repair size (for example, piston sleeves of engines are polished after chromium plating, plunger pairs - sanded with GOI pastes. Polished surfaces are washed in a stream of paraffin or hot water.

Plasma thinning is a new method of coating metal on their worn surfaces when restoring parts. Plasma flow is used as a heat source in plasma liquid coating. Plasma is heated to a very high temperature and has electrical conductivity properties. An electric arc is generated between the anode and cathode to obtain a plasma current, and a plasma-forming gas is introduced into the combustion zone of this arc. As the gas passes through the arc, it is heated to high temperatures and ionized, that is, it decomposes into positive and negative ions. The arc surface is compressed under the influence of an electromagnetic field, the arc extends in the direction of flow due to the presence of excess pressure in the gas. Then the current density increases sharply and the flow temperature increases. The plasma flow emerges from the nozzle of the plasmatron in the form of a thin line, the length of the visible part of which reaches 60 mm. Argon, nitrogen, helium, hydrogen and their mixtures are used as plasma-forming gas. The flow of argon plasma is at a very high temperature, and the flow rate is greater than the sound velocity. In plasma liquid coating, the liquefied material is introduced into the welding bath in the form of powder or wire. The powder is either introduced directly into the welding bath or blown into the plasma stream. The plasma liquid coating method ensures high quality of the liquefied metal and does not lag behind

other methods with its technical and economic performance. Sometimes it is better than them. Restoration of details with galvanic and chemical coatings Galvanic coating is based on the properties of the separation of metals from a solution of metal salts under the influence of an electric current. When a cathode is connected to the negative pole of a detail current source, a metal sits on its cracked surface. The anode connected to the positive pole of the current source serves as the second electrode. Both electrodes are placed in a solution of detachable metal salts. Galvanic and chemical coatings are applied to fill the cracked area of the part. They are also used as anti-corrosion or cosmetic coatings. Galvanic plating methods are widely used for chromium plating, forging, nickel plating, galvanizing and copper plating, and chemical plating methods for oxidation and phosphating.

Galvanic coatings are obtained from electrodes formed from an aqueous solution of metals that need to be deposited on the part. In this case, the part acts as a cathode, and the metal plate acts as an anode. When a current flows through the electrolyte, the cathode settles to the metal and the anode melts. The technological process of coating the details consists of preparing the parts for coating, laying the coating and processing the coated parts. Galvanic coatings allow you to fill the worn surfaces without overheating the parts and restore them to their original dimensions. The working details of the strains are restored by galvanic chromium plating. The process of delivery of chromium to corroded surfaces is often used to restore 0.25-0.3 mm of corroded parts, as well as to protect them from corrosion.

Chrome plating is blue-white. The hardness of the chrome laid on the detail is NV 800 - 1000, the resistance to corrosion and corrosion is great. The service life of chrome-plated parts increases 4-10 times depending on the operating conditions. Chrome plating can be applied to raw and refined steels.

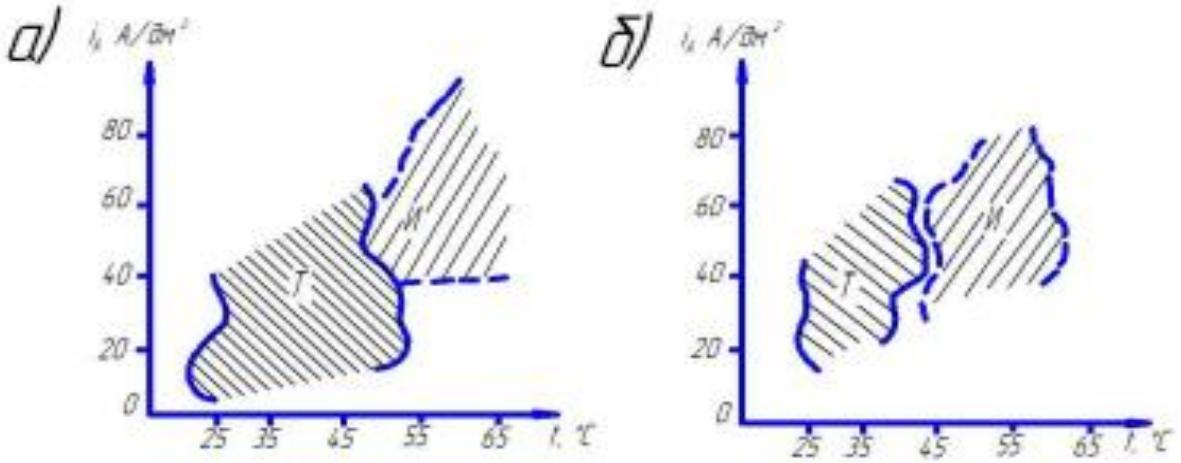

Figure 2. Hard surface (T) and wear-resistant (I) chrome plating. a) CrO3 - 150 g / l concentration b) CrO3 - 250 g / l concentration.

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