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Research Article

PROCESSES FOR SPECIAL SURFACE PREPARATION OF NON-FRONTOUS METALS BEFORE COATING

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ABSTRACT

Currently, there are new, important tasks in the field of galvanotechnics. In addition to coatings with good corrosion resistance and mechanical properties, it is required to create coatings with high gloss and special magnetic properties, high conductivity, heat resistance, and the ability to retain the hardening property even after long storage in the air. At the same time, automatic control and acceleration of the process, control of electrolytic processes, and the introduction of automation of management are also important.

KEYWORDS

Aluminum, tin, zinc, vibrogrinding and vibropolishing, copper (II) sulfate, oxalic acid, sulfuric acid, hydrogen peroxide, thiourea, chromic anhydride, chloride and sulfuric acids, inhibitor, carpentry glue, corrosion, etc.

INTRODUCTION

The purpose of preparing the surface of the object to be coated with a metal coating is to remove rust, oil, oxide film and other defects using mechanical, chemical and electrochemical methods.

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Often, a 0.2-0.7% solution of household soap is used as a working medium. To speed up the process, especially when processing ferrous metals, the soapy solution is heated to 40-50 °C. The duration of use of the solution is up to 24 hours, after which it is necessary to replace it. To improve the quality of processing, surfactant additives are added to the soapy solution. "Petrov contact", NP-2 and NP-3 preparations and detergents such as "Progress" are effective in processing ferrous metals. In addition to soap solutions, other solutions are used for polishing and polishing processes.

Aqueous solutions in product processing

Item material	Composition of the solution, %	
	Polishing	Glittering
Carbon steel	$0,8Na_3PO_4 + 0,2NaNO_3$; $(1-2)Na_2SO_3 + 0,5$kanifol; $(2-3)NaOH$	$0,3Na_3PO_4 + 0,8NaSiO_3$; $0,2Na_2SO_3 + 0,2CaSO_3$; $0,2NaNO_2$
Corrosion resistant steel	$0,2Na_2SO_3 + 0,25NaNO_3+ + 0,2Ca(OH)_2$; $0,8Na_3PO_4 + 0,2NaNO_3$;	$1,0Na_2SO_3 + 0,25NaNO_3+ + 0,2CaO$;
Aluminum, tin, zinc and their alloys	$0,8Na_3PO_4$	$1,0CrO_3 + 0,5H_2SO_4$;
Copper and its alloys	$(0,5-1,0)Na_2SO_3$; $0,8Na_3PO_4$	$1,0CrO_3 + 0,5NaCl$

Vibration treatment is one of the most modern methods of preparing the surface of the object to be coated. Vibration processing (vibrogrinding and vibropolishing) is a process of mechanical or chemical-mechanical leveling of micro-uniformities and removal of small particles of metal and its oxide with particles of the working medium.

Vibrochemical processing is a somewhat effective method. Chemically active liquids are used as a working solution in processing using this method. The difference between this method and the method of vibration processing is that the use of chemical solutions leads to the formation of a porous film with passivating properties. For vibrochemical processing, solutions of metal salts are used, which have a higher electropositivity compared to the electrode potential of the metal being processed. When choosing a working environment, it is necessary to take into account its oxidizing effect, formation of galvanic pairs,

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mechanical solubility, easy cleaning of details from reaction products.

In the vibrochemical treatment of ferrous metals, it is considered appropriate to use one of the solutions with the following composition (g/l):

-copper(II) sulfate (10-50) + oxalic acid (60) + sulfuric acid (9) + hydrogen peroxide (13) + thiourea (3);

-chromic anhydride (10) + "Progress" detergent (10-15);

- hydrochloric and sulfuric acids (5 %) + PB-8 inhibitor carpentry glue (0.5-1.0).

For vibrochemical treatment of brass, solutions with the following composition (g/l): copper(II) sulfate (80-120) + 25% solution of ammonia (100-140) are used.

Aluminum and its alloys are treated with solutions of sodium alkali with a concentration of 10-30 g/l.

- Degreasing in alkaline solutions. Alkaline degreasing can be carried out in pure alkaline solutions, in solutions with special surfactants added, and by adding surfactants to alkaline solutions. The alkaline method of degreasing is based on the properties of solutions and solutions of alkali metal salts to wash away fats and oils, as a result of which they are easily removed from the surface of the treated surface. Surface degreasing in solutions containing surfactants is based on:

- the treated surface is washed in an aqueous solution of surfactants;

- the contaminated product formed due to emulsification, dispersion, suspension, solubilization is removed from the surface of the processed material;

- the contaminated product is retained in the washing solution and is removed from the degreasing bath in suspended, emulsified and solubilized form.

Alkaline environment has a positive effect on the surface-active substances contained in the washing solution, increases its dispersing properties and increases the stability of the suspension resulting from the cleaning of the suspension.

The inclusion of silicates in the composition of the washing solution ensures the inhibitory properties of the solution against the treated metal.

Phosphates reduce the hardness of water, dissolve carbonates of multivalent metals, convert iron salts into complex compounds and neutralize them. In addition, phosphates have the property of suspending and peptizing solid particles, so the contaminated product is retained in the solution in a finely dispersed form and, as a result, does not settle on the surface being degreased.

Detergents use anionic and foaming agents as surfactants. For degreasing, parts are immersed in a bath or washed in special machines in a stream of degreasing solution.

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Before covering plastic parts with metals, they are degreased for 5-10 minutes in solutions with the following composition: 15-20% sodium carbonate; 15-20% solutions of sodium phosphate or 5-10% solutions of "Progress" detergent.

Electrochemical Degreasing Electrochemical degreasing of a metal coating before applying it to the surface is one of the most effective methods of surface cleaning. In this method, under the influence of current, emulsification is observed at the expense of hydrogen bubbles in the cathode or oxygen bubbles in the anode.

Electrochemical degreasing also uses solutions with a lower concentration than chemical degreasing.

Electrochemical degreasing solutions are required to easily wash away oils, easily emulsify contaminated products, have high electrical conductivity, and it is mainly determined by the concentration of alkali, sodium carbonate. Surfactants are not added to these solutions or are added in minimal amounts. At the same time, they tend to form foam, which makes it difficult for the separation of gases in the electrodes and causes the formation of explosive gas mixtures.

Non-ferrous solutions are degreased only at the cathode, and most ferrous metals are degreased first at the cathode and then at the anode (tk:ta=5:4). As the temperature and current density increase, the degreasing process accelerates, but the consumption of electricity decreases. In industry, it is possible to stop the complete diffusion of hydrogen into the metal by using an alternating current with a frequency current density of 8-10 A/dm2 and a voltage of 10-15 V.

The composition of degreasing solutions is given in the table below. In all cases, the electrolysis process is carried out at 3-8 A/dm2, the temperature of the solution with added surfactants is 50-60°C.

Electrolyte	**Concentrations of solution components, g/l**					
	1	**2**	**3**	**4**	**5**	**6**
NaOH	10	30-40	100	30-60	-	-
Na_3PO_4	20-30	50-60	-	-	30-40	50-60
Na_2CO_3	20-30	20-30	50	20-35	5-10	40-50
Suyuq shisha	3-5	8-10	3-5	5-10	3-5	3-5
Sintanol DS-10	-	1-2	-	-	-	1-2
Electrolyte	**Concentrations of solution components, g/l**					
	7	**8**	**9**	**10**	**11**	
NaOH	-	10-12	10-20	10-20	-	

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Na_3PO_4	40-50	10-12	-	30-50	25-30	
Na_2CO_3	-	10-12	15-30	20-30	25-30	
Liquid bottle	-	20-25	-	3-5	-	
Sintanol DS-10	-	-	-	-	1-2	
Note: Solution 10 contains 1-5 g/l Progress detergent.						

Solutions 1 and 2 are designed for degreasing steel products. Solution 2 is used for degreasing copper and its alloys, and solution 3 is a universal liquid for degreasing steel products and metal details coated in special devices. Solutions 7 and 8 are used to cover zinc and its alloys, and solution 9 is used to cover nickel and nickel-plated details. Solution 10 is used for degreasing steel, titanium, kovar, invar products and for degreasing steel products before coating with cadmium. Solution 11 is used for degreasing under the influence of constant current.

The electrochemical pickling method ensures that the metal does not completely displace hydrogen during the pickling process, reduces the consumption of chemicals, and shortens the duration of the process. Electrochemical etching of metal occurs mostly at a constant current anode.

After degreasing and washing, a passive film is formed on the surface of the metal, which must be removed before immersing the details in the coating bath. Activation (removal of the passive film on the surface) is especially important for corrosion-resistant and heat-resistant steels.

It is impossible to obtain a high-quality coating without activating such films formed at the expense of alloying components.

Carbon steels, copper, nickel and their alloys are activated in 5-10% sulfuric or hydrochloric acid solutions or their mixtures.

When chroming corrosion-resistant steels, their electrochemical activation can be carried out directly in the chroming bath itself at J=30-50 A/dm2, t=50±5 °C, t=15-30 seconds. Then the items are transferred to the cathode, and chrome plating is carried out in the usual mode.

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