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## RESEARCH POLYMER COATINGS MATERIAL PROPERTIES AND APPLICATION FEATURES

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### ABSTRACT

*This article describes the coating processes on the working surfaces of many parts from different polymeric materials. Obtaining coatings from polymers is superior to other coatings in terms of quality, efficiency and low cost. coatings made of polymer composite materials in order to protect working surfaces from corrosion and increase the durability of service parts made of metals. They are quite resistant to chemicals, so it will not be possible to remove the polymer layer with a solvent. The coating can only be removed with a special tool. Pural is not as resistant to plastic deformation as plastisol, and is more expensive than polyester, but in terms of price-quality ratio, it is the best option from all of the above. Pural coatings are most widely used in the production of galvanized metal roofing elements.*

**KEYWORDS:** *Polymer, Polyester, Plastisol, Pural, Coating, Anti-Friction, Material.*

### INTRODUCTION

Polymer coatings are used to protect metal parts from corrosion and give them a decorative appearance. Antifriction coatings are a special type of polymer materials, which not only prevent wear of parts, but also serve as a lubricant. Polymer coatings are intended for the treatment of metal surfaces in order to protect against corrosion and give a decorative appearance. Polyester, polyvinylidene fluoride (PVDF), plastisol, pural, etc. can be used as a polymer coating. Let's consider these materials, their areas of application and application technologies in more detail.

### Methods and objects of research

**Polyester.** Polyester (polyester) is the most popular polymer used as a coating. It is characterized by high resistance to UV radiation, excellent anti-corrosion properties, elasticity (easy to form). Figure 1. The polyester coating can withstand almost any temperature - both low and high. Compared to other types of polymers, polyester is the most affordable. Compared to other types of polymers, polyester is the most affordable. Not too outstanding strength characteristics of the material are compensated for by additional processing with quartz sand. However, the cost of coating is increased. Transportation of products with a polyester-quartz protective layer presents certain difficulties, since sand can damage adjacent surfaces.



**Figure 1. Polyester coating**

### PVDF coating

Polyvinylidene fluoride (PVDF) is used to protect metals not much less often than polyester. This polymer consists of polyvinyl chloride (80%) and acrylic (20%). PVDF forms a shiny, fade-resistant layer on parts, therefore it is often used as a decorative coating. This material can give the surface a gloss, metallic effect, copper or silver tint. Polyvinylidene fluoride is resistant to mechanical stress and has the longest service life of all polymers. PVDF is used to treat metal surfaces that are exposed to aggressive environments.

### Plastisol

Plastisol, like PVDF coating, has excellent decorative properties. In terms of cost, it is the most expensive, but at the same time it has the best resistance to mechanical damage. Figure 2. Plastisol is applied in a thick layer (up to 200 microns) and is used to create textured coatings, embossed surfaces and stamped patterns.



**Figure 2. Plastisol coating**

This material perfectly protects parts from moisture and corrosion, however, under the influence of very high temperatures (over + 80 ° C) and direct UV radiation, it can lose its properties. That is why it is not recommended to use it in southern latitudes (in extreme cases, you can use light-colored plastisol with maximum reflectivity).

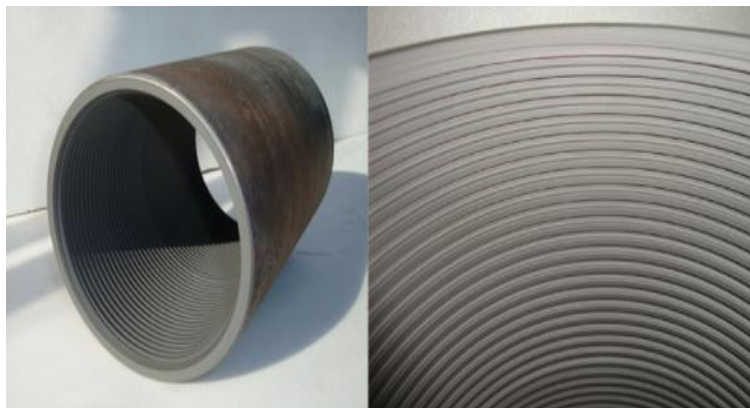
### **Pural**

Pural is made on the basis of polyurethane and modified polyamide. The pural coating has a silky-matte surface, high temperature resistance and resistance to sudden temperature changes. This material does not fade and does not deteriorate under the influence of chemically aggressive environments. Pural is not as resistant to plastic deformation as plastisol, and is more expensive than polyester, but in terms of price-quality ratio, it is the best option from all of the above. Pural coatings are most widely used in the production of galvanized metal roofing elements. Steel treated with pural gains a beautiful appearance, high anti-corrosion properties and resistance to UV radiation.

### **Polymer anti-friction coatings**

Antifriction solid lubricating coatings are a special type of polymer protective materials. Outwardly, they look like paints, but the pigment in their composition is replaced by highly dispersed particles of solid lubricants: molybdenum disulfide, graphite, polytetrafluoroethylene, etc. Figure 3.

**Figure 3. Polymer anti-friction coatings**



Solid lubricants are evenly distributed in a polymer binder: epoxy, titanate, polyurethane, acrylic, phenolic and other resins. The demand for antifriction solid lubricating coatings is due to their excellent performance characteristics: high bearing capacity, a wide range of operating temperatures, extreme pressure and anti-corrosion properties. Unlike conventional polymer coatings, anti-friction coatings withstand prolonged exposure to chemically aggressive media and extreme loads. At the same time, they perform not only a protective, but also a lubricating function, which also benefits from polymers.

Domestic coatings MODENGY can be cited as an example of such materials. They are used in a wide variety of industries and the automotive industry. Figure 4.



**Figure 4. Polymer anti-friction coating**

Typical coating units are medium and heavy loaded bearings, guides, gears, internal combustion engine parts (piston skirts, throttle valve, etc.), Threaded joints and other friction pairs made of various materials (metals, rubbers, plastics.) MODENGY anti-friction solid lubricating coatings are applied once for the entire service life of parts, which allows you to completely abandon oils and greases for further maintenance.

#### **ADVANTAGES AND DISADVANTAGES OF POLYMER COATINGS**

Polymer coatings have both undeniable advantages and obvious disadvantages.

The advantages of polymers include:

- Aesthetics
- Impermeability
- Relative heat resistance
- Electrical insulating properties
- Resistant to water
- Environmental friendliness
- High adhesion
- Large selection of colors

However, along with the positive aspects, polymer coatings are not without drawbacks. The main one is the high cost of application, which consists of the cost of the polymer itself, auxiliary (primer) materials, special equipment, etc.

Another disadvantage of polymer coatings is the difficulty of removing them. They are quite resistant to chemicals, so it will not be possible to remove the polymer layer with a solvent. The coating can only be removed with a special tool. A significant drawback of polymers is the impossibility of applying them without special tools, which are available only to industrial

enterprises or narrow specialists. Among other things, not all metals can be coated with polymer compositions, but only those that conduct electric current. This is due to a special method of applying polymers - by magnetic induction.

## POLYMER COATING

Equipment plays a major role in polymer spray coating. Figure 5.



**Figure 5. The spray gun coating**

The spray gun tank is positively charged while the part to be painted is negatively charged. Due to this, when the polymer composition comes into contact with the surface of the product, a phenomenon similar to the magnetic induction when the electrode is closed occurs.

The entire application process is divided into stages, the adherence to which directly affects the quality of the final result. With the slightest deviations from technology, the performance of the polymer coating can be reduced to zero. At the first stage of work, the surface is prepared: it is thoroughly cleaned of dirt and degreased, those areas that do not need to be processed are closed. This is followed by preliminary priming of the product, application of the coating itself, varnishing is possible. All operations take place in a special closed chamber, isolated from the penetration of dust and other particles. One of the main requirements for this camera is good illumination, allowing the technician to see the surface of the part and apply the coating from any angle. The work-piece to be processed is suspended on special hooks, a negative charge is applied to it, and the coating is started. The whole process takes a lot of time, the material is applied in one layer to avoid unevenness.

The third stage is polymerization. The coated product is slowly warmed up in a special chamber with a maximum temperature of  $+200^{\circ}\text{C}$ . The process takes about 1 hour. The curing temperature and time depend on the layer thickness. An important factor in proper drying is the slow and uniform heating of the oven, during which the coating spreads over the part, penetrating into all hard-to-reach places. At the last stage, the product is cooled. For this, the temperature in the oven is gradually reduced to  $+100^{\circ}\text{C}$ . Do not allow the chamber to cool rapidly, as cracks may appear on the polymer coating. It is also forbidden to open the oven, as the temperature difference will cause the same consequences. The cooled part is removed from the oven and placed in a chamber for applying paint or varnish. This operation is optional and rather decorative. This gives the polymer coating additional shine and depth. Anti-friction solid lubricating coatings can be applied by standard painting methods: spraying, dipping,

centrifugation, screen printing. Spraying is the easiest way. To implement it, you will need a spray gun with precisely tuned parameters, a source of compressed air and the coating itself.

### CONCLUSION

In conclusion, it should be noted that coatings made of polymer composite materials not only increase the life of the coated surface in terms of quality, but also have a positive effect on the efficiency of the work. prevents unnecessary costs by protecting working parts from corrosion and external aggressive environment.

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