ISNN 3030-3907

2026/4
VOLUME 5

DEVELOPMENT OF SCIENCE

ILMIY JURNAL



Development of science

Ilmiy jurnal

2026/4 VOLUME 5

ISSN 3030 -3907

Ilmiy jurnal OAK rayosatining 2024 yil 27 sentabrdagi 361-son qaroriga asosan 02.00.00 kimyo fanlari hamda 2025 yil 12 fevral 367- son qaroriga asosan 05.00.00 texnika fanlari bo‘yicha falsafa doktori (PhD) va fan doktori (DSc) ilmiy darajasiga talabgorlarning dissertatsiya ishlari yuzasidan dissertatsiyalari asosiy ilmiy natijalarini chop etish tavsiya etilgan milliy ilmiy nashrlar ro‘yxatiga kiritilgan.

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ISSN 3030-3907

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ISSN 3030-3907

OPTIMIZATION OF TECHNOLOGICAL PARAMETERS FOR THE ELECTROSTATIC COATING FORMATION PROCESS

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Annotatsiya. Mashinasozlik sanoatida ishlatiladigan detallar ko‘pincha ishqalanish, zarba yuklamalari va agressiv muhit ta’sirida ishlaydi. Natijada detallar sirtida yeyilish jarayoni tezlashadi va ularning xizmat muddati qisqaradi. Ushbu muammoni hal qilishning samarali usullaridan biri elektrokontaktli qoplama texnologiyasidan foydalanishdir. Tadqiqot davomida tok kuchi, elektrod bosimi va qoplama materialining sirtga ta’siri tahlil qilindi. Natijalar shuni ko‘rsatdiki, optimal texnologik parametrlarni tanlash orqali qoplamaning qattiqligi, yeyilishga chidamliligi va sirtning mexanik mustahkamligi sezilarli darajada oshadi.

Kalit so‘zlar: elektrokontaktli qoplama, sirt muhandisligi, yeyilishga chidamlilik, mashinasozlik detali, qoplama texnologiyasi.

Аннотация. Детали, используемые в машиностроительной промышленности, часто работают под воздействием трения, ударных нагрузок и агрессивных сред. В результате ускоряется процесс износа поверхности деталей и сокращается срок их службы. Одним из эффективных способов решения этой проблемы является использование технологии электроконтактного покрытия. В ходе исследования были проанализированы влияние силы тока, давления электрода и материала покрытия на поверхность. Результаты показали, что за счет выбора оптимальных технологических параметров значительно повышаются твердость покрытия, износостойкость и механическая прочность поверхности.

Ключевые слова: электроконтактное покрытие, поверхностная инженерия, износостойкость, машиностроительная деталь, технология покрытия.

Abstract. Parts used in the mechanical engineering industry often operate under the influence of friction, impact loads, and aggressive environments. As a result, the wear process on the surface of the parts accelerates and their service life is reduced. One of the effective ways to solve this problem is the use of electrical contact coating technology. During the study, the influence of current strength, electrode pressure, and the coating material on the surface was analyzed. The results showed that by selecting optimal technological parameters, the hardness,

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wear resistance, and mechanical strength of the coating surface are significantly increased.

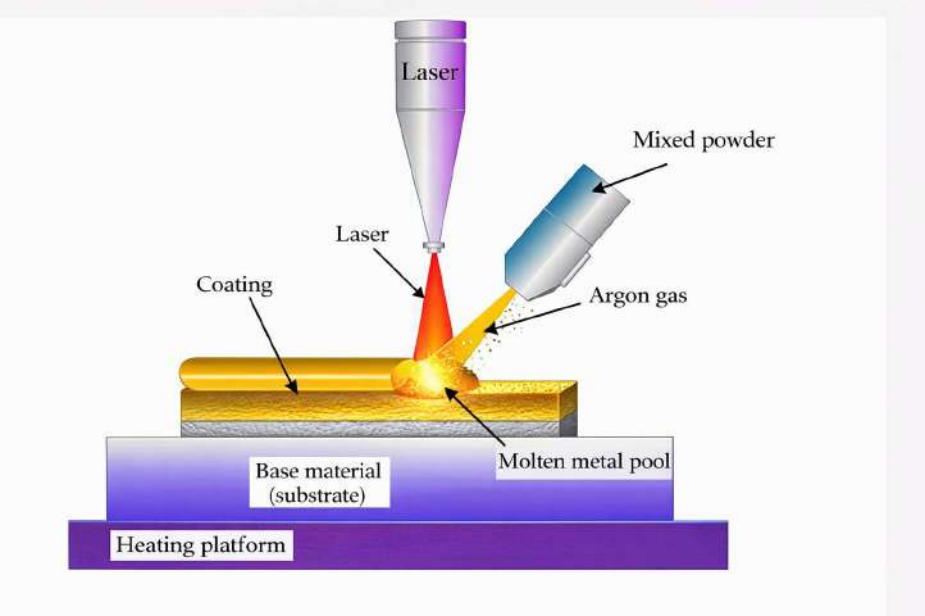
Keywords: electrical contact coating, surface engineering, wear resistance, mechanical engineering part, coating technology.

1. INTRODUCTION.

Parts used in the mechanical engineering industry encounter various mechanical and tribological loads during operation. Under these conditions, surface wear on parts leads to a reduction in their service life. Therefore, improving the mechanical properties of the surface layer is one of the important directions of mechanical engineering technology.

One method of surface reinforcement is the electroswitch coating technology. This technology allows for the firm bonding of the coating material to the base metal surface under the influence of electric current and mechanical pressure. The electrostatic coating process is characterized by high energy efficiency and technological simplicity.

1.Schematic of the electrostatic coating process



The electrical contact coating process includes the following main elements:

1. The electrode conducts electric current and creates pressure.
2. Coating material - a layer that strengthens the surface
3. The main part is the machine-building element for which the coating is applied.
4. The source of electric current provides heating energy.

Under the influence of an electric current, the surface heats up and the coating material binds firmly to the base metal under pressure.

2. Research methodology

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During the study, the influence of the following technological parameters of the electrocontact coating process was studied:

• current strength III
• electrode pressure PPP
• composition of the coating material;
• process duration

The following indicators were studied to evaluate the quality of the coating:

• surface hardness;
• wear resistance;
• coating layer thickness;
• bond strength between the coating and the base metal;

4. Effect of current strength on coating quality

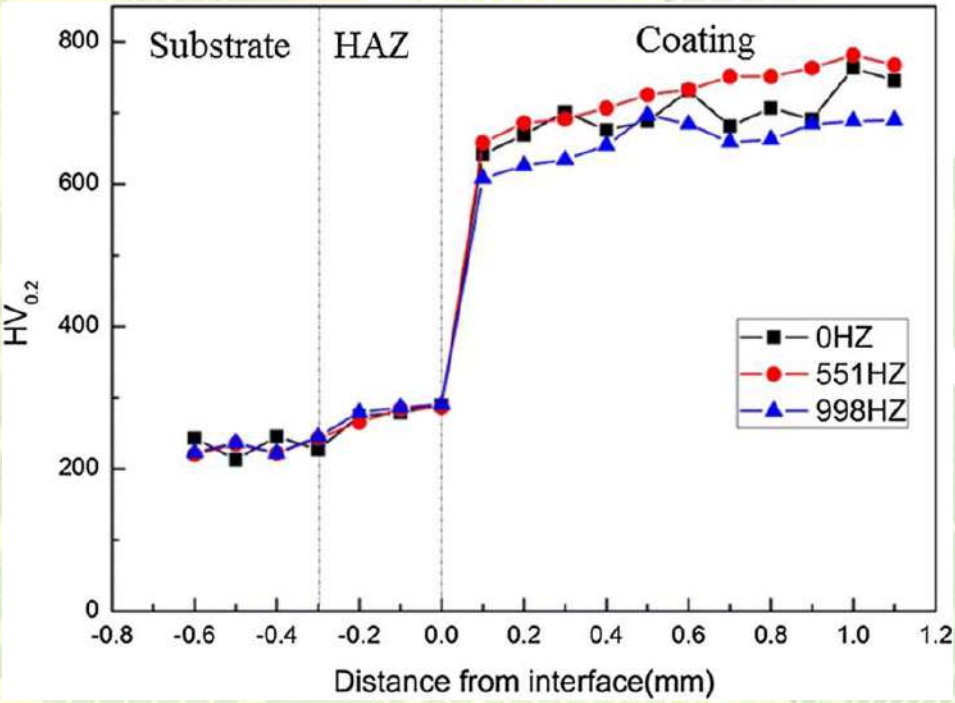
Current strength and coating formation rate

The current forces the deposition of metal ions onto the surface.

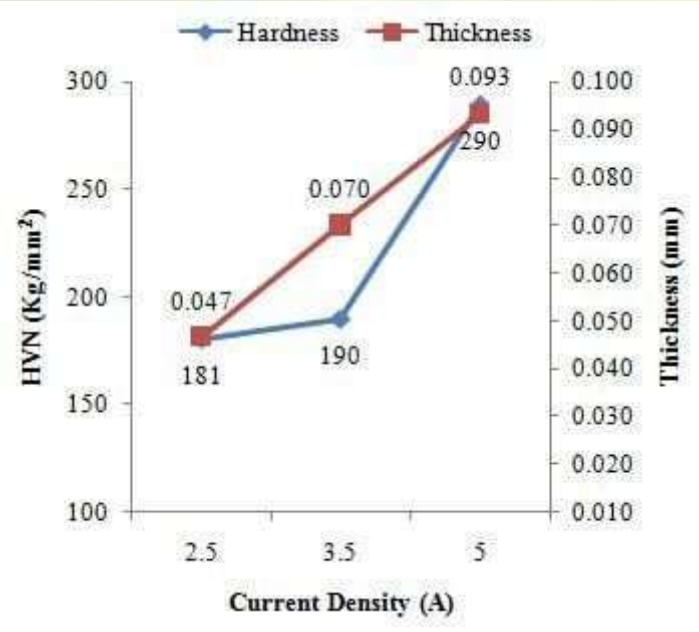
The greater the current, the faster the coating forms and the thicker it becomes.

Low current → slow but controlled coating

High current → fast, but may have quality issues



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Experimental results showed that:

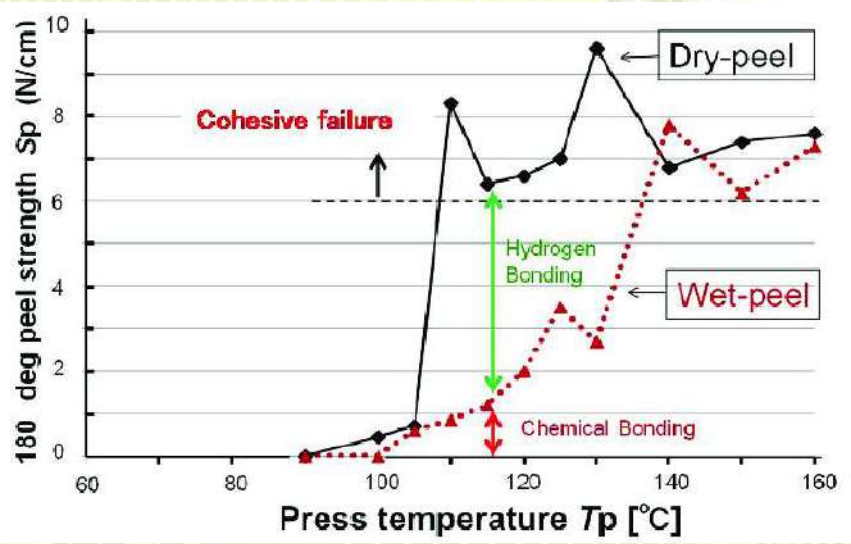
• at low current values, the adhesion of the coating layer is insufficient;

• surface deformation occurs at very high current values;

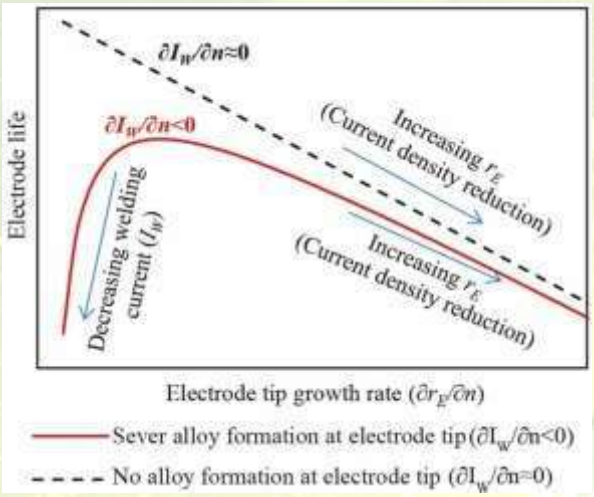
• at the optimal current value, the hardness of the coating layer reaches its maximum level;

According to the results, it was observed that the coating hardness increases by 30-40% when optimal parameters are selected.

5. Effect of electrode pressure



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Electrode pressure affects the metallurgical bond between the coating and the base metal.

According to the research results:

• low pressure leads to a decrease in coating quality;

• very high pressure causes metal deformation;

• optimal pressure ensures high coating strength;

6. Results and discussion

The conducted research showed that when selecting the optimal values of technological parameters:

• coating hardness increases significantly;

• wear resistance increases by 1.5–2 times

• improves the uniformity of the coating layer;

• surface performance improves;

This makes it possible to extend the service life of mechanical engineering parts.

7. Conclusion

Optimizing the technological parameters of the electroswitch coating formation process significantly improves the operational properties of mechanical engineering components.

The research results show that:

• optimal current strength increases the hardness of the coating layer;

• optimal electrode pressure strengthens the metallurgical bond;

• correct selection of technological parameters increases wear resistance;

Electric contact coating technology is considered one of the promising methods for surface reinforcement in the mechanical engineering industry.

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ISSN 3030-3907