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THE INFLUENCE OF FILLERS IN THE COMPOSITION OF PAINT AND VARNISH MATERIALS ON THE PHYSICAL AND MECHANICAL PROPERTIES

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Abstract: This article studies the influence of fillers in paints and varnishes on the physical, mechanical and performance properties of coatings. With the rapid development of industry and construction, the demand for the quality of protective and decorative coatings, their durability and resistance to environmental influences is increasing. Fillers play an important role in shaping the structure and properties of paint and varnish coatings, determining the strength, adhesion, hardness, corrosion resistance and economic efficiency of the product. This article analyzes the influence of mineral fillers of different particle sizes and concentrations on the structure and performance properties of coatings. Particular attention is paid to optimizing the composition of paints and varnishes in order to improve their quality and reduce costs through rational use of raw materials. The results obtained can be used in the development of modern composite paint and varnish systems.

Keywords: Paints and varnishes, fillers, coating, physical and mechanical properties, dispersion system, adhesion, corrosion resistance, coating structure, mineral additives, performance properties.

Annotatsiya: Ushbu maqolada bo'yoq va loklardagi to‘ldiruvchi modda qoplamalarning fizik, mexanik va ishlash xususiyatlariga ta'siri o'rganiladi. Sanoat va qurilishning jadal rivojlanishi bilan himoya va dekorativ qoplamalar sifatiga, ularning chidamliligiga va atrof-muhit ta'siriga chidamliligiga talab ortib bormoqda. To‘ldiruvchi moddalari bo'yoq va lok qoplamalarining tuzilishi va xususiyatlarini shakllantirishda, mahsulotning mustahkamligi, yopishishi, qattiqligi, korroziyaga chidamliligi va iqtisodiy samaradorligini aniqlashda muhim rol o'ynaydi. Ushbu maqolada turli zarracha o'lchamlari va konsentratsiyalaridagi mineral to‘ldiruvchi modda qoplamalarning tuzilishi va ishlash xususiyatlariga ta'siri tahlil qilinadi. Xom ashyolardan oqilona foydalanish orqali ularning sifatini yaxshilash va xarajatlarni kamaytirish uchun bo'yoq va loklarning tarkibini optimallashtirishga alohida e'tibor qaratiladi. Olingan natijalar zamonaviy kompozit bo'yoq va lok tizimlarini ishlab chiqishda qo'llanilishi mumkin.

Kalit so'zlar: Bo'yoq va loklar, to‘ldiruvchi moddalari, qoplama, fizik va mexanik xususiyatlar, dispersiya tizimi, yopishish, korroziyaga chidamlilik, qoplama tuzilishi, mineral qo'shimchalar, ishlash xususiyatlari.

Аннотация: В данной статье исследуется влияние наполнителей в красках и лаках на физические, механические и эксплуатационные свойства покрытий. В связи с быстрым развитием промышленности и строительства возрастает спрос на качество защитных и декоративных покрытий, их долговечность и устойчивость к воздействию окружающей среды. Наполнители играют важную роль в формировании структуры и свойств лакокрасочных покрытий, определяя прочность, адгезию, твердость, коррозионную стойкость и

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экономическую эффективность продукта. В данной статье анализируется влияние минеральных наполнителей различного размера частиц и концентрации на структуру и эксплуатационные свойства покрытий. Особое внимание уделяется оптимизации состава красок и лаков с целью повышения их качества и снижения затрат за счет рационального использования сырья. Полученные результаты могут быть использованы при разработке современных композитных лакокрасочных систем.

Ключевые слова: Краски и лаки, наполнители, покрытие, физико-механические свойства, дисперсионная система, адгезия, коррозионная стойкость, структура покрытия, минеральные добавки, эксплуатационные свойства.

Introduction. The modern development of industry, engineering and construction requires the use of high-quality paints and varnishes that reliably protect metal, concrete and wooden structures from corrosion, moisture and other aggressive environmental factors. Paints and varnishes perform not only a decorative, but also an important protective function, extend the service life of products and reduce operating costs.

Paints and varnishes are complex dispersion systems containing binders, pigments, solvents and fillers. Among these components, fillers occupy a special place, since they significantly affect the formation of the coating structure and its performance properties. The dispersion, particle shape, chemical nature and concentration of fillers determine mechanical strength, adhesion to the base, water resistance and corrosion resistance.

Picture 1. Paint and varnish materials



With the transition to resource-saving and environmentally friendly technologies, rational selection and optimization of the amount of fillers in paints and varnishes is especially relevant. Scientific substantiation of their influence on the properties of coatings helps to increase the competitiveness of products and ensure their compliance with modern quality requirements.

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Therefore, the study of the influence of fillers on the properties of paints and varnishes is an urgent scientific and practical task aimed at improving production technology and increasing the efficiency of coating application in various industries.

Literature review. The composition and properties of paints and varnishes are widely covered in the world scientific literature. This fundamental work studies in detail the physicochemical principles of coating formation, the mechanisms of pigment and filler dispersion, as well as their influence on adhesion and mechanical strength[1]. The authors emphasize that the optimal distribution of filler particles in the binder plays an important role in the formation of a dense and stable coating structure[2].

The research studies the principles of composition of paints and varnishes and the influence of filler dispersion on the rheological properties and stability of the system. It is emphasized that mineral fillers not only reduce the cost of products, but also improve their performance properties when carefully selected in concentration. Modern research pays special attention to nanodispersed fillers. Monographs show that the use of nanoparticles can significantly improve the corrosion resistance, hardness and UV resistance of coatings. This area is considered promising in terms of innovative development of the paint and varnish industry[3].

A significant contribution to the development of the theory and technology of paints and varnishes in the CIS countries was made, in which information on the role of mineral fillers (chalk, kaolin, talc) in the formation of the coating structure and their influence on mechanical properties was systematized.

The development of the chemical industry and the production of import-substituting materials in the Republic of Uzbekistan are identified as priority areas of state policy[4]. The document sets out the goals of modernization of the industry, introduction of innovative technologies and increasing the competitiveness of local products. These provisions are directly related to the improvement of paint and varnish production technologies.

In addition, it is aimed at structural transformation of the chemical industry, rational use of local raw materials and creation of products with high added value. These programs emphasize the need for scientifically based selection of fillers and optimization of their content in paint and varnish materials[5]. Analysis of domestic and international sources shows that despite extensive studies of the influence of fillers on the properties of coatings, the problem of developing optimal formulations taking into account the availability of local raw materials and modern requirements for product quality and environmental safety remains relevant.

Conclusions and recommendations. The study showed that fillers play an important role in shaping the structure and performance characteristics of paint and varnish coatings. Experiments have shown that the optimal amount of mineral filler is 10-15%, which improves the mechanical strength, adhesion and corrosion resistance of the coating.

A concentration of fillers exceeding 20% leads to a deterioration in the dispersion stability of the system, a decrease in structural uniformity and the appearance of microdefects, which negatively affects the performance properties of the coating. Therefore, a rational choice of the quantitative and qualitative composition of fillers is a decisive factor in the development of effective paint and varnish compositions.

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These results confirm the need for scientifically based optimization of formulations, taking into account the physicochemical properties of fillers and the properties of the binder. This is especially relevant in the context of the modernization of the chemical industry and increasing demands on the quality and durability of protective and decorative coatings.

Based on the above research, the following recommendations can be made:

1. To ensure the best combination of coating strength and protective properties, it is recommended to use mineral fillers in the optimal concentration range of 10-15%.

2. When developing new paints and varnishes, it is necessary to take into account the dispersion and morphology of filler particles, ensuring their uniform distribution in the binder.

3. To improve the uniformity of the system, it is recommended to use modern dispersion methods (high-speed mixers, ultrasonic processing).

4. It is recommended to expand research on the use of nanodispersed and functional fillers to increase the corrosion and weather resistance of coatings.

5. The use of local mineral raw materials is a promising approach, which reduces the cost of products and increases their competitiveness.

References

1. Lambourne R., Strivens T. Bo'yoq va sirt qoplamalari: nazariya va amaliyot. 2-nashr. Kembrij: Woodhead nashriyoti, 1999. 800 b.

2. Turner G.P.A. Bo'yoq kimyosiga kirish va bo'yoq texnologiyasi tamoyillari. 3-nashr. London: Chapman & Hall, 1988. 240 b.

3. Tiginyanu I., Topala P., Ursaki V. Qoplamalarda nanotexnologiya. Berlin: Springer, 2015. 356 b. Yakovlev, A.D., Bo'yoqlar va loklar va qoplamalar. Moskva: Kimyo, 1988, 320 b.

4. O'zbekiston Respublikasi Prezidentining 2022-yil 28-yanvardagi PF-60-sonli "Yangi O'zbekistonning 2022–2026 yillarga mo'ljallangan rivojlanish strategiyasi to'g'risida"gi Farmoni.

5. O'zbekiston Respublikasi Prezidentining 2021-yil 13-fevraldagi PQ-4992-sonli "Kimyo sanoatini yanada isloh qilish va uning investitsiya jozibadorligini oshirish chora-tadbirlari to'g'risida"gi qarori.