

AP19680121 “Development of compositions of sand-polymer composite materials and technological support of their processing into machine-building products” – p.m. Nikonova T.Yu.

Relevance:

The project involves the creation of production of products for mechanical engineering and construction industry, characterized by high profitability (high content of inexpensive filler and the use of thermoplastic polymer waste), increased performance characteristics (compressive strength not less than 100 MPa).

The project purpose:

The project purpose is to develop compositions of sand-polymer composite materials modified with functional components and technological support of their processing into products for mechanical engineering with an increased level of performance characteristics.

Expected and achieved results:

Achieved results:

- on the basis of the conducted modeling the optimal design of the bearing unit of the conveyor roller has been developed. Static and dynamic analysis of the obtained models was carried out, allowing to determine the main characteristics of the obtained models of the conveyor roller bearing unit;

- Model samples of the developed composite materials, including those with the use of regenerated components on the basis of secondary polymer waste, have been produced. The machinability of the developed composite compositions by various methods of blade machining has been evaluated to achieve increased accuracy of surfaces of structural products;

- by means of 3d modeling the prototype - solid model of the developed composite materials, including the use of reclaimed components based on secondary polymer waste to establish the real parameters of deformation and strength, tribotechnical, thermophysical and other characteristics of composites in products. The imposition of static and dynamic loads made it possible to evaluate the main characteristics of the obtained material, including physical and strength properties, the forecast of further changes in the strength properties of the material was given;

- Experiments were conducted on the obtained samples for their machinability and technological accuracy on different types of metal-cutting equipment, taking into account systematic and random parameters. The analysis of the influence of composition and content of components of sand-polymer basis of the composite on deformation-strength, thermophysical and technological characteristics of experimental samples of materials and products, as well as the conditions of their combination when using activation treatment of components in the process of formation of polymer composite matrix has been carried out.

- submitted article Tatyana Nikonova, Nataliya Val'ko, Aliaksandr Skaskevich, Andrey Kasperovich, Olga Zharkevich, Alexandra Berg, Gulnara Zhetessova, Essim Dandybaev. “Study of the Influence of X-ray Radiation on the Structure and Elastic-Strength Properties of Elastomers Based on Nitrile Bu-tadiene Rubber” in the peer-reviewed scientific publication Polymers (MDPI), indexed in Science Citation Index Expanded of Web of Science (Q1) and having a CiteScore percentile of 81% in Scopus. (Preprint).

Expected results:

as a result of the project realization a new technology of obtaining compositions of sand-polymer composite materials and technological support of their processing into machine-building products will be developed.



Figure 1 - Process of conducting experimental research and obtaining results

List of publications:

1. T.YU. Nikonova, G.S. Zhetessova, O.M. Zharkevich, A.A. Skaskiewicz, N.D. Strekal
On the possibility of using sand-polymer composite materials in the products of machine-building purpose// VESTRIC of L.N. Gumilyov Eurasian National University. Gumilyov Eurasian National University. Series of technical sciences and technologies № 3/2023 - P.89-99

2. Tatyana Nikonova, Nataliya Val'ko, Aliaksandr Skaskevich, Andrey Kasperovich, Olga Zharkevich, Alexandra Berg, Gulnara Zhetessova, Essim Dandybaev. "Study of the Influence of X-ray Radiation on the Structure and Elastic-Strength Properties of Elastomers Based on Nitrile Bu-tadiene Rubber" in the peer-reviewed scientific journal Polymers (MDPI), indexed in the Science Citation Index Expanded database of the Web of Science (Q1) and having a CiteScore in the Scopus database of 81%.

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Information for potential users:

The project involves the creation of polymer composite systems based on thermoplastic binders, as well as the use of quartz fillers for reinforcing binders based on polymeric and oligomeric components. The project is focused on the use of the existing raw material potential available to the industrial enterprises of the Republic of Kazakhstan and the Republic of Belarus, without the use of imported components of composite polymer systems, including through the involvement in the production of regenerated polymeric thermoplastic materials based on waste of domestic and industrial origin.

The target consumers of the obtained project results can be machine-building enterprises, mechanical parks of large and medium-sized enterprises of the mining industry, enterprises - producers of composite materials, enterprises specializing in recycling. The applicability of the obtained scientific results is also possible in scientific and design organizations, as well as in higher educational institutions, when teaching bachelors, masters and doctoral students.

Scope:

The field of application of the technology is quite extensive. Products made of composite materials have a high level of wear resistance and strength with their relative lightness and mobility. The technology realized as a result can be applied to the fields of mechanical engineering and construction, in the creation of military equipment, in space and aviation, for the manufacture of consumer goods.

Information update date: 05.07.2024