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

Relevance

The project involves manufacturing products for mechanical engineering and the the construction industry that is characterized by high profitability (high content of inexpensive filler and the use of thermoplastic polymer waste), improved performance characteristics (compressive strength of at least 100 MPa).

Project objective

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

Expected and achieved results

Achieved results:

- a set of design documentation "Bearing unit housing" was developed based on the developed compositions of polymer composites, including technological equipment, technological conditions and technological regulations for obtaining composite materials and manufacturing products;

- a technology was created for manufacturing products for mechanical engineering and the construction industry that are highly profitable (high content of inexpensive filler and the use of thermoplastic polymer waste) with improved performance characteristics (compressive strength of at least 100 MPa);

- optimal compositions of sand-polymer composites for the bearing unit housing: PPK60: LDPE-9; PP-8; stearlic acid - 3; quartz sand (0.1 mm) - 60; PPK65: LDPE-8; PP-23.7; stearlic acid - 3.3; quartz sand (0.1 mm) - 65; PPK70: LDPE-6.6; PP-19.9; stearlic acid - 3.5; quartz sand (0.1 mm) – 70.

An article was published in Scopus (33% percentile) by Nikonova T.Yu., Zhetessova G.S., Beisembayev K.M., Abdugaliyeva G.B., Zharkevich O.M., Skaskevich A.A. Chamber mining of minerals in complex mining and geological conditions without carbon emissions // Coal, 11, 2024, 57-63 DOI: http://dx.doi.org/10.18796/0041-5790-2024-11-57-63.

Expected results:

- a prototype of the "Bearing unit housing" design will be manufactured based on the obtained composites of the optimal structure, technological conditions of their formation, ensuring the achievement of the required level of operational parameters. 1 article or review will be published in a peer-reviewed foreign or domestic publication recommended by the CQASHE;

- bench and industrial test programs will be prepared and agreed upon, Implementation Acts will be received indicating recommendations for the use of the developed technology at machine-building enterprises of Kazakhstan, Belarus and Russia, license agreements will be prepared. 1 article will be published in peer-reviewed scientific journals indexed in Science Citation Index Expanded and included in the 1 (first) and (or) 2 (second) quartile by impact factor in the Web of Science database and (or) having a percentile by CiteScore in the Scopus database of at least 65 (sixty-five). A patent of the Republic of Kazakhstan for an invention will be obtained. The monograph will be published in English by a foreign publisher.

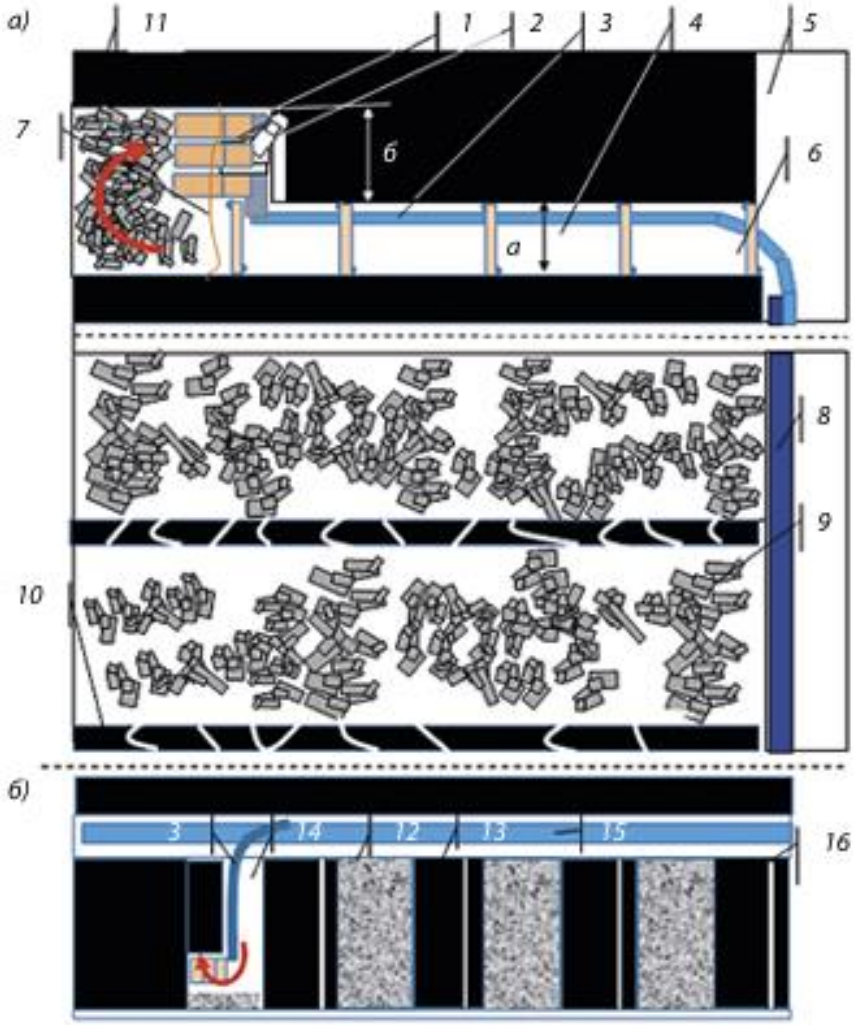

Figure 1 – Diagram of small-component robots with a loader attachment: a: 1 – section of face support type OKP – 70; 2 – loader; 3 – rotary scraper conveyor; 4 – portable support in the chamber; 5 – main drift; 6 – chamber; 7 – roof break line; 8 – drift conveyor; 9 – worked-out chambers; 10 – inter-chamber collapsed pillars; 11 – intact massif; b: 12 – collapsed chamber; 13 – secondary mining pillars; 14 – working chamber; 15 – production conveyor; 16 – well

List of publications

1. T.Yu. Nikonova, G.S. Zhetesova, O.M. Zharkevich, A.A. Skaskevich, N.D. Strekal On the possibility of using sand-polymer composite materials in engineering products// BULLETIN OF L.N. Gumilyov ENU. Series: Technical Sciences and Technologies, No. 3/2023, pp. 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 Butadiene Rubber" in the peer-reviewed scientific journal Polymers (MDPI), indexed in the Science Citation Index Expanded of the Web of Science (Q1) and having a CiteScore percentile in the Scopus database of 81%.

3. Nikonova T.Yu., Zhetesova G.S., Beisembaev K.M., Abdugalieva G.B., Zharkevich O.M., Skaskevich A.A. Chamber extraction of minerals in complex mining and geological conditions without carbon emissions // Coal, 11, 2024, 57-63 DOI: http://dx.doi.org/10.18796/0041-5790-2024-11-57-63.

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Information for potential consumers

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

The target consumers of the obtained project results may be machine-building enterprises, mechanical parks of large and medium-sized enterprises in the mining industry, enterprises - manufacturers of composite materials, enterprises specializing in the processing of secondary raw materials. The applicability of the obtained scientific results is also possible by scientific, design organizations, as well as in higher education institutions, when training bachelors, masters and doctoral students.

Scope

The scope 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 resulting technology can be applied in the fields of mechanical engineering and construction, in the creation of military equipment, in astronautics and aviation, for the production of consumer goods.

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