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The Development of a Test Stand for Developing Technological Operation "Flotation and Separation of MD2. The Deposition of Nanostructures MD1" Produce Nanostructures with Desired Properties

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Absrtact.

Presented calculation of the stiffness and strength of the stand structure is carried out with the aim to find out the greatest deformation of the stand frame as of the weight of all elements that are hung on the frame, and stand on its own weight. The requirements for stiffness and strength of the stand design at work impose its mark when making design decisions. To substantiate a constructive solution, was analyzed the stiffness and strength of the structural elements of the stand.
Use modern approach to perform engineering analysis of rigidity and strength of the developed design is the use of special software for the structural analysis of mechanisms. The project produced the calculation of strength and rigidity of the frame stand. The calculation is performed by the finite element method Ansys WorkBench v.14 system resources. We define the basic properties of the materials.
The distribution of the absolute total deformation (displacement) shows that the weakest point is the average part of the vertical stand. The maximum displacement in the frame reach 0.29 mm. The resulting displacement did not exceed the permissible values. This structure has the necessary rigidity. Designed and calculated structure stand on the stiffness and strength, we can conclude that the structure in exploitation process will be operational.
Keywords: nanoparticles, froth flotation, foam separation, flotation, flotation stand.

INTRODUCTION

Until now, the majority of specialists in the flotation is believed that aeration should be done in small (activating the mineral surface of the particle floated) and major transport bubbles [1,2]. But this is the wrong approach, because:

1. The large transport bubbles in most cases simply float in the amount of pulp without forming any flotocomplex with a mineral particle, and in some cases destroy flotocomplex due to its high rate of ascent (kinetic energy);

2. The presence of bubbles in the pulp polydisperse system - flotation foam is less stable [3, 4, 5], watery and has a lower height;

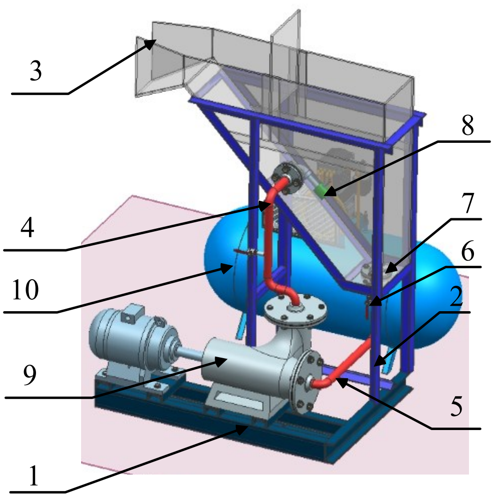
3.In the flotation of shallow nano-sized and micro-sized particles larger bubbles are carried all the particles (hydrophilic and hydrophobic) - the separation of particles of two required components does not occur [6-8];

4. The excess pulp mixing in the presence of polydisperse system of the starting bubbles increases the energy consumption for the flotation process [9-11].

In this paper describes the creation of experimental stand the flotation of nanoparticles.

DESCRIBES RESULTS OF THE CREATION OF EXPERIMENTAL STAND.

General view of the designed test rig is shown in Figure 1.



1 - a support; 2 - frame; 3 - capacity; 4 - supply; 5 - discharge; 6.7 - flanges; 8 - aerator; 9 - Pump 50E8; 10 compressor.

Figure 1: Test bench for testing MOT "Flotation and separation of MD2. The deposition of nanostructures MD1 " produce nanostructures with desired properties

The following are the main elements that make up the stand. The pump is purchased products and must be purchased from the supplier of the finished product. The remaining elements of the stand are manufactured in-house.

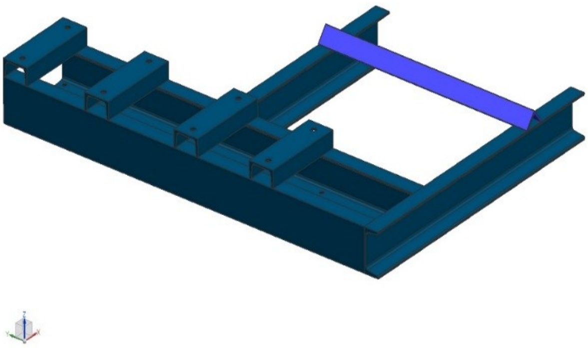


Figure 2: Support

The support is made of steel channel №1 GOST 8240-89. On the support there are mounting holes for mounting the pump.

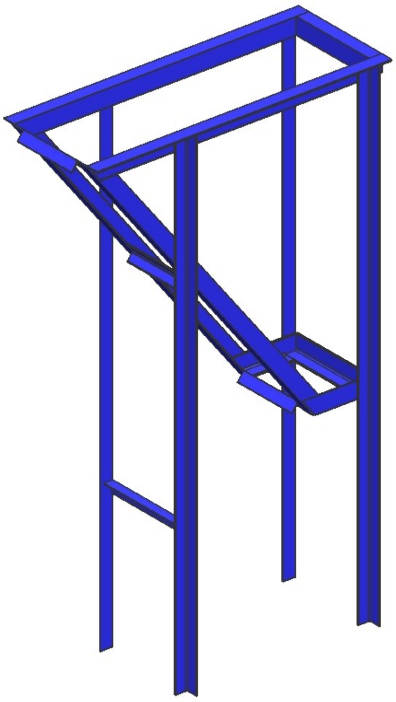


Figure 3: Framework

Stand frame made of steel equal angles 45x45x4 GOST 8509-86 by welding using DES in accordance with GOST 5264-80.

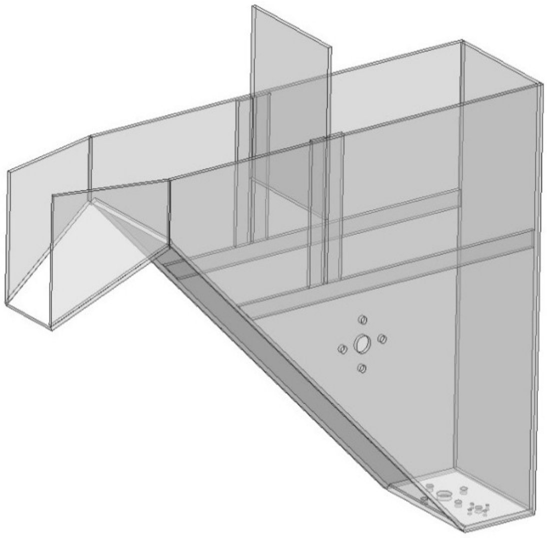


Figure 4: Capacity

Container for implementation of the flotation process is made of plexiglas by soldering on the junction interface wall. On the end of the hopper capacity with the help of bolting is mounted the feed drive. On the bottom, it is similar mounted the discharge of raw materials.

Figure 5 : Supply

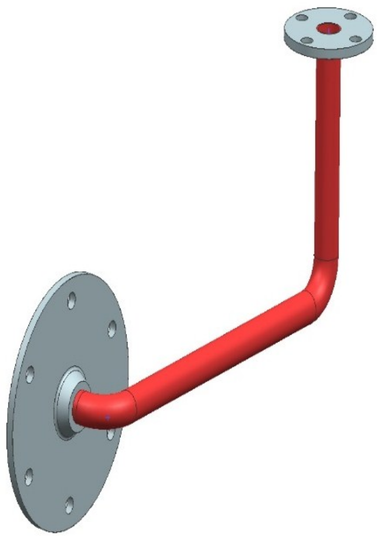


Figure 6: Withdrawal

Taps are made of steel pipe Du32x3,5 GOST 8734-75, the ends of which are welded with steel connecting flanges.

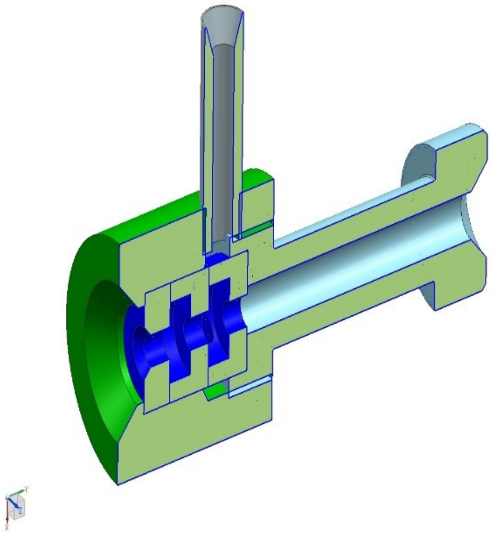


Figure 7: aerator

The aerator is designed as an assembly unit in which the feedstock is fed by the pump and air compressor.

Figure 8: Compressor type AIRCAST SB4 / C-100. LH20A

The compressor is required for stable supply of air in the concentrates separation system.

Calculation of the stiffness and strength of the stand structure is carried out with the aim to find out the greatest deformation of the stand frame as of the weight of all elements that are hung on the frame, and stand on its own weight.

The requirements for stiffness and strength of the stand design at work impose its mark when making design decisions. To substantiate a constructive solution, it is necessary to analyze the stiffness and strength of the structural elements of the stand.

The traditional method of such analysis is a method based on the knowledges of the subject “the resistance of materials”. However, this method requires special training of the designer in the field of knowledge on “the resistance of materials”. In addition, the traditional method is less productive compared to the modern method.

Modern approach to perform engineering analysis of rigidity and strength of the developed design is the use of special software for the structural analysis of mechanisms. The project produced the calculation of strength and rigidity of the frame stand. The calculation is performed by the finite element method Ansys WorkBench v.14 system resources.

The frame stand is designed as a volumetric structure with equal angles. Tank attached to the frame.

From the working conditions of this design, it can be seen that the entire load of the elements is evenly distributed throughout the frame stand.

The frame is made from a material St3. We define the basic properties of the material, the result is summarized in Table 1. In this engineering calculations material is used as the isotropic.

Table 1: Main properties of materials

Material	Bulk density ρ, kg / m3	E Modulus, MPa	Poisson's ratio	Tensile elasticity, MPa
Steel 3	7831	200	0,3	250

Existing load defined as the weight of the container. The application will place the inner surface parts.

The boundary conditions of finite-element model include securing conditions and applied loads. Secure conditions - rigid sealing of the frame bottom surface.

Thus, there is little introduced assumptions about the boundary conditions, which reduce the time of calculation, and calculation error is not more than 5%.

To perform the analysis, the model's body was divided into finite element mesh. The total number of tetra elements - 150125. In the model is used tetra and hexa elements, depending on the geometry of the geometric model of each body.

Now let us analyze the results.

The stress distribution is shown in Figure 9, the strain distribution is shown in Figure 10. In the diagram the voltages are given in MPa. The stress distribution shows that the maximum voltages are 14.97 MPa.

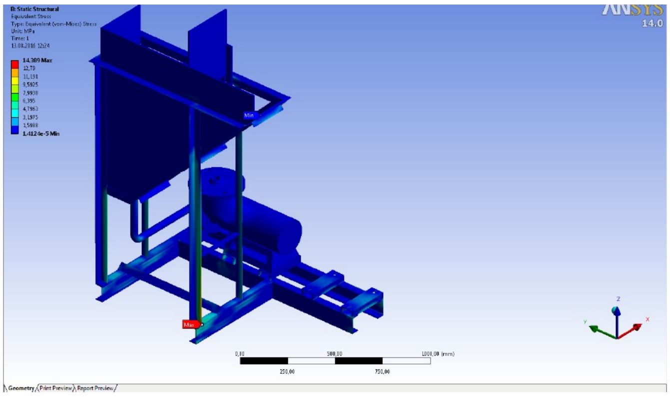


Figure 9: The diagram of stress on the Von Mises in stand design, MPa (14.97 MPa max.)

When analyzing the stiffness was determined by the total deformation (movement) Fig. 10.

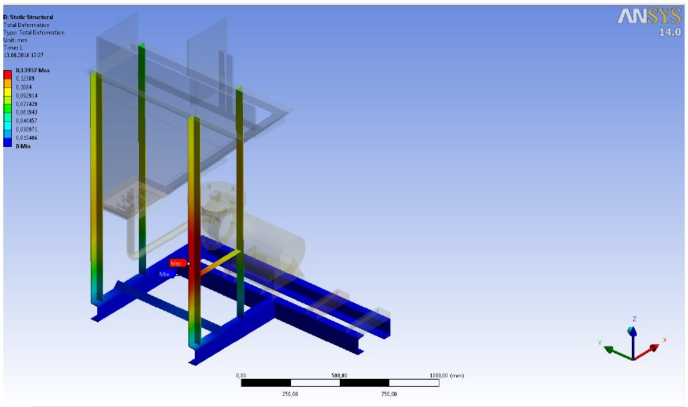


Figure 10: The diagram of deformations in the stand design, mm (max 0,29mm.)

CONCLUSION

Thus, the strength is ensured.

The distribution of the absolute total deformation (displacement) shows that the weakest point is the average part of the vertical stand.

The maximum displacement in the frame reach 0.29 mm. The resulting displacement did not exceed the permissible values [1 mm].

Thus, this structure has the necessary rigidity. Designed and calculated structure stand on the stiffness and strength, we can conclude that the structure in exploitation process will be operational.

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