## ANALYSIS OF THE EFFECTIVENESS OF BASALT FIBER PIPES IN THE SYSTEM OF OILFIELD PIPELINES

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Pipeline transportation is one of the most affordable and efficient mode of transport liquid and gaseous hydrocarbons today. Oil, oil products and natural gas are delivered through pipelines both over long distances and within the fields. Every year, millions of cubic meters of oil and technical fluid are transported through oilfield pipelines. They contain plenty of corrosive agent. Due to the excessive aggressivity of fluids, the main problem arising during the field pipeline operation is the corrosion of equipment, which is the cause of 90% of failures. Such accidents entail environment pollution, production decline, as well as extra material costs for the total overhaul of pipelines and environmental measures [1]. This raises the question of whether application of new high-strength corrosion-proof structural materials, which in the future could be a replacement for traditional steel pipes. First of all, such materials include polymer composites, which contain reinforcing material (fibers or other components) and a binding matrix. One of the most potential direction is the use of basalt fiber pipes [2].

The purpose of the research is to identify the main advantages of using basalt fiber pipes instead of steel ones in the transportation of hydrocarbons, as well as to determine the effectiveness of their use in oil fields by means of pipeline hydraulic and thermal design.

As part of the study, both a literature review of existing methods of making and application of basalt fiber pipes, and a detailed study of new developments were made. A basalt fiber pipe satisfying the operating conditions for the Northern regions of Western Siberia was selected for further calculations (Ttable 1). As per procedure, the pipeline hydraulic and thermal design of steel and basalt fiber pipeline is carried out under equal conditions.

***Table 1***

***Pipe properties***

| Name of parameter | Unit measure | Value of a quantity |
|---|---|---|
| Length, L | m | 860 |
| Outside diameter, D | mm | 163 |
| Wall thickness, δ | mm | 6,5 |
| Heat exchange factor, k | W/m ·K | 0,26 |
| Pipe wall roughness, Δ | mm | 0,015 |

The study revealed some advantages of basalt fiber pipes over steel, the main ones are: high corrosion and adhesion resistance, low conductivity, negligible pipe wall roughness, as well as easy installation and operation processes. Corrosion resistance is caused by the full absence of any types of corrosion, which significantly increases the life of the pipe. The full absence of welded joints and the low weight of the pipes can significantly reduce costs of installation process of the pipeline. The negligible wall roughness of the basalt pipe and, as a result, the smaller wax and mechanical impurities accumulation reduce the friction head, as well as increases the operational properties of the field pipeline [3]. In addition, basalt fiber pipes are more effective for use in low-temperature conditions due to low thermal conductivity and more resistant to dynamic loads. The results of the calculations are presented in Table 2.

***Table 2***

***Calculation data***

| Name of parameter | Unit measure | Value of a quantity |
|---|---|---|
| Decrease of temperature, ΔT | $^0$C | 1,83 |
| Loss of pressure, ΔP | MPa | 0,071 |
| Increase of pressure when hydrocare, Ps | MPa | 0,58 |

Thus, the introduction of basalt pipes in the transportation of hydrocarbons is a promising direction of the oil and gas industry today. But the market of basalt fiber pipes is small it is caused by the need regulatory framework development and the development of new methods of control of composite products.

References

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