

Please fill in the name of the event you are preparing this abstract for.	International Petroleum Technology Conference	
Please fill in your 5-digit IPTC manuscript number and IPTC Control number.	IPTC-19189-MS 19IPTC-P-1565-IPTC	
Please fill in your abstract title.	Development of Scientific Fundamentals of Control for Physical and Mechanical Soil Properties in the Extreme North Conditions	
Please fill in your author name(s) and company affiliation.		
Given Name	Surname	Company
Vladimir	Burkov	Tomsk Polytechnic University
Petr	Burkov	Tomsk Polytechnic University
Lyubov	Altunina	The Institute of Petroleum Chemistry

Abstract

Design, construction and operation of main pipelines should tackle such problems as ensuring high levels of durability and stability of underground structures in the longer term. A territory in which pipe laying is provided, is characterized by adverse and unstable natural climatic conditions.

In order to create barrier waterflooding in oil-and-gas fields in the North conditions, it is expedient to utilize cryotropic polymeric compositions with controllable hydrophobic properties as reinforcement layer. This reinforcement subgrade layer tightened with cryogel, protects soil layers from displacements relative to each other and also serves as a waterproofing during seasonal temperature variations. Cryotropic material forms after a freeze-thawing cycle as a result of a phase transfer from viscous-flow state to an elastic polymeric body (cryogel) which is able to withstand strong deformations. It should be noted that the strength and elasticity of cryogel increases with each freeze-thawing cycle.

Cryogel possesses such properties as water-proofing, high strength, elasticity and high level of adhesion to rock. There is a sufficiently high likelihood of the practical application of construction gel because it can be manufactured directly at a production site and then pumped into drillholes using conventional techniques. We propose to pump cryogel through drillholes into the trench bottom from both sides. Directional drilling is to be used to drill holes in order to create a supporting system in the form of three-dimensional lattice structures at a distance of up to 10 meters. The lattice elements are reinforced core samples. Lattice points are formed in crossings, which add the spatial strength and stability to the lattice structure. The right and the left lattices are connected in the middle of the trench bottom. Such a connection of lattices forms an elastic three-dimensional structure which will significantly increase the total strength of the system, allow withstanding static loads of the pipeline, distribute them uniformly over the pipe, and transfer them to lower soil layers. All this will exclude a non-uniform settling of the trench bottom, thereby preventing it from the creep flow.

The scientific novelty of this research lies in the development of production techniques of composite cryogel-based materials with the addition of fillers (soils, rocks, sand, construction mixes, etc.) and nanodispersed additives which modify their physicochemical properties and the stress-strain behavior (hydrophily/hydrophoby, strength, elasticity, etc.), and the use of the concept of hierarchical nanostructures for the creation of cryogels.