Novel High-performance Stages of Submersible Electric Centrifugal Pumps for Abnormal Well Operation

We offer for broad implementation novel high-performance pump stages, which are notable for a large overhaul period in operation of wells containing a high amount of abrasive particles and corrosion-active substances.

The novel stages of multi-stage submersible pumps were created by a combination of two innovation elements: a novel revolutionary compact stage design with the open impeller (developed by Yu.A. Sazonov and comprehensively investigated at the Gubkin Russian State University of Oil and Gas) and an up-to-date composite material, which is a wrought aluminium alloy with a protective ceramic polymer coating (developed by SIA Mikrolat).

The novel compact pump stage consists of an open impeller and a split-design diffuser. These stages have good hydrodynamic characteristics and create a much larger head than standard stages with closed impellers. The efficiency of the novel stages in pumping borehole fluid with a high content of free gas (over 6%) is 5–10% greater than the efficiency of standard stages.

The low weight and small mounting height of the novel stages enable reducing by one half the weight of the pump rotor (on which impellers are mounted), which results in improved dynamic characteristics of the pump and significantly smaller vibrations. This makes possible an increase of rotor rotation frequency from 3000 up to 6000 rpm and higher, which significantly increases the performance of the pump.

The processibility of novel stages' components and ease of treatment of aluminium alloys make them convenient for series production. The cost of fabricating a novel stage is 25% lower that the cost of producing a standard stage from nickel-containing iron (Ni-resist).

The protective coating, consisting of a ceramic layer impregnated with fluoropolymer, is created on the surfaces of components from aluminium alloys.

The ceramic coating is created by the method of third-generation plasma electrolytic oxidation (PEO) developed by SIA Mikrolat. The coating 50–70 μm thick is formed in 15–20 min, which is acceptable for series production.

The ceramic PEO coating withstands excellently hydroabrasive and gas-erosion wear, as well as successfully resists impact, cavitation and thermocyclic loads.

Impregnation of the microporous structure of PEO coatings with fluoropolymer enhances the anticorrosion properties of the coatings. The low roughness and the presence of polymer on the surface of pump stage components enables decreasing the hydraulic resistance of flow channels, prevents deposition of mineral salts on the surface, provides for the minimal friction coefficient in tribopairs.

Benchmark trials of the novel stages, conducted at the Gubkin Russian State University of Oil and Gas, showed a many-fold increase (up to 10 times) of wear resistance and corrosion resistance as compared with standard Ni-resist stages.

The results of such trials, as experience has shown, are transferable almost completely to full-scale specimens. However, the final judgement on the efficiency of using the novel pump stages can be made only after field tests.

We invite companies interested in the appearance of high-performance submersible pumps in the market to participate in field tests of pumps with the novel stages and in further implementation of the pumps in abnormal oil production.

For more information, please contact:

SIA Mikrolat
3C Carnikavas Str., Riga, Latvia LV-1034

Tel/Fax: + 371-7414 335, +7-495-435-1432
e-mail: mikrolat@inbox.lv
www.mikrolat.lv