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MODERN PROBLEMS OF HIGH-VISCOSITY OIL PRODUCTION

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Abstract
One of the urgent problems of the oil industry is to improve the efficiency of well operation. It is of particular relevance in the development of anomalous (non-Newtonian) oil deposits, where the operation of wells is complicated by the manifestation of anomalies in the viscosity and mobility of oil, the formation of asphalt-resin-paraffin deposits (ARPD) and high-viscosity emulsions in the bottomhole zone of the reservoir (UPZ).

Keywords: bitumen, light oil, paraffin, tar, gasoline, thermogas, molybdenum, polymer, wells.

Introduction

Production of hard-to-recover oil reserves (hereinafter referred to as TPP) is one of the urgent tasks of the oil industry today. TPPs mainly include heavy and high-viscosity oils (viscosity above 50 mm2/s). Their reserves significantly exceed the reserves of light and low-viscosity oil. Natural bitumen also belongs to the TIZ. Bitumens are superheavy oils with a density of more than 1000 kg/cubic meter and a viscosity of more than 10,000 mPa-s, oxidized high-viscosity oils of liquid, semi-liquid and solid consistency with a high content of sulfur, asphaltenes, resins, paraffins. Bitumen is distinguished by a high content of metals: vanadium, nickel, molybdenum, and a much lower content of light gasoline fractions. The development of bitumen is quite promising: energy carriers, varnishes, paints, polymers are produced on their basis.

The industrial development of bitumen deposits located at shallow depths - from 30 to 300 meters - began with the use of open-pit and mine mining methods, which required high energy costs and had a negative impact on the environment. Since the 70s of the twentieth century, the method of in-situ combustion using thermogas generators began to be introduced. And since the 90s, the Canadian production technology has become widespread: oil production through two wells by heating the reservoirs with superheated steam. At the same time, the methods of drilling horizontal wells with two wellheads and supplying hot steam to the reservoirs were successfully developed. Thus, the first stages of oil field development: exploration, drilling, heating of bitumen to a liquid state have been successfully implemented, which proves the prospects and economic feasibility of natural bitumen production by the borehole method.

The next necessary task for the development of such fields is pumping oil production, transportation of oil to gathering and treatment points, processing in order to obtain final products.

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Analysis of modern existing designs of downhole pumping equipment, as well as the experience of operating well pumps, reveals a number of serious problems and shortcomings in the production of high-viscosity oil by these pumps.

Firstly: the impossibility of pumping with sucker rod pumps, both screw and plunger, due to the small radius of curvature of wells and the presence of a horizontal section.

Secondly: limited production opportunities with submersible electric centrifugal and electric screw pumps. Operation of wells by electric centrifugal pumps, as a rule, is possible only in a periodic mode, due to the low daily flow rate of the well and the impossibility of stable regulation of the pump capacity in the range of low flows - up to 25 m3 of liquid / day, which leads to equipment downtime, complication of restarts, clogging of the pump with solid particles. In addition, ESPs are not multiphased, and the extraction of high-viscosity fluid with a high solids content leads to rapid wear of equipment, a sharp drop in pump performance, and frequent supply failures. Another disadvantage of ESP units is the limited ability to operate in a horizontal position, due to the effect of surfacing of the centrifugal stage impeller, which leads to a difficult start-up and bringing the unit into operating mode. Twin screw submersible electric pumps (EVN) are more efficient than ESP units, due to their ability to pump viscous media and the ability to provide a small daily flow rate from 2 to liquid / day, but they are very sensitive to the presence of solid particles that quickly wear out the working elements of the pump - screws and stator. Single-screw (screw-excentric) pumps require the use of either a reliable small-sized gearbox as part of the unit, or the use of a valve submersible electric motor to ensure low rotation speeds - up to 300 rpm. However, the presence of a stator made of elastomers (rubber or polyurethane) significantly limits the operation in terms of temperature parameters and the content of solid fractions in the pumped liquid.25 $м^3$

The main modern technical trends in the development of pumps for the production of bitumen oil - the use of diaphragm pumps and cord pumps - have a number of drawbacks. In the design of diaphragm pumps, there are distribution valves, cord pumps are low-performance and require the development of non-standard wellhead equipment.

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