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## Modelling of non-linear viscoplastic oil flow to a well

Sergey Gubanov, Vladimir Astafev, Valeriya Olkhovskaya and Aleksey Zinoviev  
Samara State Technical University, Russia

Extraction and designing of systems for the development of high-viscosity oil is one of the most perspective direction of development of the fuel and energy complex. During the last few decades, deposits have been explored and introduced into the world, many of which was presented by deposits of oil with high viscosity. As a rule, oils of this class have pronounced rheological properties due to the content of high-molecular components. Experimental studies have proved the ability of high-viscosity oil to display at flow the properties typical of non-Newtonian systems. The relationship between pressure gradient and rate of movement in real reservoirs may be non-linear due to the interaction of asphaltenes and resins, forming the plastic structure in the oil. The impact of the restructuring processes on the viscosity of the oil and the possibility of Darcy's law violation are not considered in most of the known hydrodynamic simulations. The authors of the article justified the analytical model of the pseudostationary flow of non-linear viscoplastic oil to the vertical well with a random configuration of the drainage area. The result of the study is the choice of the system of reservoir stimulation, which allows effective regulation of the structural and mechanical properties of high-viscosity oil. Namely, periodic formation heating with help of grid wells with dual-well system. The effect is reached by putting of solid fuel source, located in proximity to the impact object. The technical solution that supposes formation exposing with a dual-well system aims at recurrent layer warm-up with the help of a high-temperature solid-fuel or liquid source located in the bottom-hole zone of the vertical well bore and production of formation water through the additional lateral hole located within the warm-up radius outside the zone of expected rock damage. Small-sized subsurface pumping equipment is run in the hole, e.g. with pump location in the lateral hole. The method proposed by the authors can be useful for small deposits of high-viscosity oil.

## Biography

Sergey Gubanov has completed his Bachelor's degree program "Exploitation and Maintenance of Oil Production Facilities", at Oil-Technological Department. In 2017, he has completed his Master's degree program in Material Engineering and Technology of Materials, summa cum laude. From the first course, he took part in different workshops, contests, conferences (Moscow, Saint Petersburg, Tomsk, Novosibirsk, Sochi, Sakhalin and other cities). During his study, he has published 13 scientific works. He is also a Co-author of the Russian Federation patent № 2607486. He has received the President's and Governor's award and the Alabin's award. Since 2015, he is a realizer of the Russian Scientific Foundation grant "Method of high-viscosity oil deposits development with possibility of periodic formation heating". Now, he works as an Assistant Professor at Samara State Technical University, "Oil and gas field development and operation" Department. He conducts laboratory and practical classes on the subject "underground hydromechanics of hydrocarbons".

gubanov0393@gmail.com

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