

# Modeling of cobalt-based catalyst use during CSS for low-temperature heavy oil upgrading

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## Abstract

© 2018 Institute of Physics Publishing. All rights reserved. One of the methods, which is actively used on deposits of heavy oils of the Upper Kungurian (Ufimian) sandstones of the Republic of Tatarstan, is cyclic steam simulation (CSS). This method consists of 3 stages: injection, soaking, and production. Steam is injected into a well at a temperature of 300 to 340 C for a period of weeks to months. Then, the well is allowed to sit for days to weeks to allow heat to soak into the formation. Finally, the hot oil is pumped out of the well for a period of weeks or months. Once the production rate falls off, the well is put through another cycle. The injection of the catalyst solution before the injection of steam opens the possibility for upgrading the heavy oil in the process of aquathermolysis directly in the reservoir. In this paper, the possibility of using a catalyst precursor based on cobalt for upgrading the hydrocarbons of this field in the process of their extraction is represented. SARA analysis on oil saturated sandstones shows an increase in the proportion of saturated hydrocarbons by 11.1% due to the hydrogenation of aromatic hydrocarbons and their derivatives, the content of resins and asphaltenes are remained practically unchanged. A new method for estimating the adsorption of a catalyst based on taking into account the change in the concentration of the base metal before and after simulation of catalyst injection in the thermobaric conditions of the reservoir is proposed. During the study of catalyst adsorption in the rock, when simulating the CSS process, it is found that almost 28% of the cobalt, which is the main element of the catalyst precursor, is retained in the rock.

<http://dx.doi.org/10.1088/1755-1315/155/1/012021>

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