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Mordovo-Karmalskoye Field: The Bitumen Composition in Productive Strata after Passing of the Combustion Front in Well

Kayukova G., Romanova U., Sharipova N., Smelkov V., Uspenskiy B., Romanov G.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The specific features of the composition of both natural bitumens of the Mordovo-Karmalskoye field and products of the bitumen thermal transformation in strata after passing of the combustion front in a well are studied. The composition of organic matter and its bitumen components left in reservoir after passing of the combustion front and the parameters of bitumen which underwent no artificial impact are compared. The combustion is found to cause the deep transformations in the bitumen composition and the differentiation of bitumen properties through a cross section. The rather light bitumen (density is equal to 0,94 g/cm³) is in the low concentration in the roof part of stratum. A content of paraffin-naphtene hydrocarbons, particularly nalkanes, increases in the hydrocarbon part of bitumen. Accordingly to the group and hydrocarbon compositions, the elemental composition is altered, the hydrogen content increases and the sulphur content decreases. Contrarily, the bitumen in the combustion interval is heavier (1,013 g/cm³). A quality of the bitumen is minimal there. The interlayers having an enhanced content of the insoluble organic compounds are found. The high content of asphaltenes causes the low hydrogen content and the high carbon content in the bitumen composition. All these parameters are abnormal if to compare with the ordinary, non-transformed bitumens of the Mordovo-Karmalskoye field. In the lower part of cross section underwent no combustion, the content and composition of bitumen become ordinary for the productive thickness. At the same time, the lower oil content and the higher content of asphaltenes and sulphur in bitumens are an evidence to the displacement of light to the productive wells hydrocarbons simultaneously to passing of the combustion front. That confirms the earlier observed fact that the oil is produced at the part of reservoir which underwent no in situ combustion. In addition to the alterations in the organic matter composition and content, the bitumen-bearing rocks are also transformed, particularly a ratio between iron(II), iron(III) compounds and pyrite is changed. The revealed factors which effect the quality of recovered bitumens and the alterations in the mineralogy make possible to control the temperature regime and passing of the combustion front.
