Study on Environmental Effect Variation Law of Oil Layer Development Characteristic after Polymer Flooding

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Study on Environmental Effect Variation Law of Oil Layer Development Characteristic after Polymer Flooding

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Abstract. This article using various dynamic / static state and monitoring data, has dissected the variation law of some parameters, such as porosity, permeability, and so on, after polymer flooding in the area analyzed the distributing and existing way of remaining oil in oil layers after polymer flooding, studied exploitation characteristic variation after the subsequent water injection breakthrough, summarized dynamic variation rules of different stages, and according to the change features, subdivided the development stages of further water flooding, evaluated the results of integrated adjustment and potential tapping in all stages.

Key words: further water flooding, oil reservoir features, environmental effect, potential tapping.

1. Condition of Oil Layer Physical Property Parametric Variation After Polymer Flooding

It has been studied to the physical property parametric variation after polymer flooding of three wells which are respectively from oil area, by using their coring data of coring wells in different times. The three wells are respectively Detection A in mid-1970s, Detection B in last-1980s and C in last-polymer flooding period[1-3].

1.1. Porosity variation

The data from the three coring wells show that: after polymer flooding, the porosity variation of high and middle water-flooded layers is little, the porosity average value rises from 28.56% to 28.71%, increasing by 0.15 percent point; the porosity of low water-flooded layers descend a little, from 30.08% down to 28.51%, decreasing by 1.57 percent point, especially the water saturation difference value between the primeval and the drilling period is 15% or so, the porosity is a little low. Porosity variation of high
1.2. Air permeability variation
By means of contrast, it is discovered that: after polymer flooding, the permeability of all low, middle and high water-flooded layers tends to increase. The three wells, Detection A, Detection B and Detection C, are all in water flooding stage. The permeability of the former two does not change much. The latter permeability rises a lot more. Thereinto, the permeability increasing range of middle and high water-flooded layers is a little more. Their average permeability rises from 1.39μm² to 1.87μm², increasing by 0.48μm², the increasing range is 34.53%. The entirety permeability of low water-flooded layers is showed increasing tendency. The average permeability rises from 1.43μm² to 1.61μm², increasing by 0.18μm², the increasing range is 12.59%. Nevertheless, there exists permeability decline range. There are two permeability concentrating areas arising. When the water saturation difference value between the beginning and the well-drilling period is 15% or so, the permeability diminishes. When the water saturation difference value between the beginning and the well-drilling period is 20% or so, the permeability trait is the same as in middle and high water-flooded layers. The increasing range is a little more.

2. Aviation Law of Further Water Flooding Exploitation Characteristic
The data indicate that after further water flooding, the water absorbing capacity of oil layers goes up[4-8]. The injection pressure rises from 8.6MPa, before polymer injection, up to 12.7MPa, after polymer injection. After further water flooding, the injection pressure drops to 8.9MPa, and at present, is steady in 10.3MPa or so. The start-up pressure rises from 5.2MPa, before polymer injection, up to 10.4MPa,
after polymer injection. After further water flooding, the start-up pressure drops to 7.5MPa; the apparent water absorption index drops from 23.7m³/(d·MPa), before polymer injection, down to 11.05m³/(d·MPa), after polymer injection. And after further water flooding, the apparent water absorption index rises again to 14.7m³/(d·MPa). After being injected polymer solution in an injection well. The straight line segment of Hall Curve obviously occurs variation; The slope increases from 0.5279 to 0.7861. After further water flooding, the slope decreases to 0.7421. The calculated residual resistance factor is 1.406. Because the further water flooding time is short, the residual resistance factor is greatly remained.

3. Stage Dividing for Changing into Further Water Flooding And Correspondingly Adjusting Potential Tapping Result

At present, the comprehensive water-containing of the Area is 95.66%. Comparing with the initial stage of stopping injection, the comprehensive water-containing rises up by 2.96 percent point. The produced liquid concentration declines from 446mg/L to 299mg/L, dropping down by147mg/L. it can concretely be divided into three development stages: The first is the transitory stage; The second is the breakthrough stage; The third is the water-bearing stabilization stage. In different stages, contraposing the oil layer permeability ratio going up in the later period of polymer flooding, rocks continue to move toward the water-loving direction. Combining distribution characteristics of remaining oil, various kinds of pertinence adjustment measures are put into effect, and the water-containing rising speed is effectively controlled[9-14].

4. Conclusion
(1) After polymer flooding, in the oil layer, the porosity variation range is not big. The permeability increasing range is a little more.
(2) After polymer flooding, rocks continue to transform to water loving trend. At the same time, the absorption effect on polymer weakens.
(3) Because the further water flooding time is short, at present, the oil layer still remains higher residual resistance factor.
(4) The dynamic data of further water flooding indicates that the polymer leading edge is gradual breakthrough.
(5) Various pertinence adjustment measures in further water flooding stage effectively control the water content rising velocity of further water flooding.

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