

# **An impact of the back-stress effect on breakdown pressure and closure pressure of hydraulic fracture.**

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Hydraulic fracturing is the mechanical impact of an injected fracturing fluid on a productive oil reservoir. This process leads to the formation of a hydraulic fracture in the medium. Its propagation in the reservoir is influenced by many factors, such as the characteristics of the rock, the characteristics of the fracturing fluid, and in particular the stress field that is realized in the formation in the immediate vicinity of the fracture that has arisen. One of the values, that has always been given the most attention, is the minimum stress distributed in the formation with a hydraulic fracture. In the course of this work, fracture breakdown pressures and fracture closure pressures were theoretically calculated. Accordingly, the minimum stress values of the model sample were calculated. The obtained values were compared with the real values that are known from the conditions of laboratory experiments on hydraulic fracturing.

A series of laboratory experiments on hydraulic fracturing using a special setup was carried out. During each experiment, pressure was recorded depending on the time in the well in which the hydraulic fracturing was created. After analyzing the obtained dependencies, the values of the hydraulic fracture closure pressures were calculated. According to the standard theory proposed by Hickman and Zoback in 1981, this value should be equal to the minimum stress in the reservoir. However, the results of processing laboratory pressure drop curves turned out to be overestimated. Also, the experimental values of fracture breakdown pressures were overestimated in comparison with the calculated ones.

In the course of this work, some factors, that influence the formation and development of hydraulic fracture, have been identified. One of these factors is the effect of back-stress. This stress occurs due to an increase in the pore pressure in the model sample when the fracturing fluid is filtered into the reservoir. It creates additional pressure from the outside on the walls of the well during the fracture formation and on the walls of the fracture during its development. This leads to an earlier closure of the hydraulic fracture formed and overestimated theoretical values of both the fracture closure pressure and the fracture breakdown pressure. It was found that taking into account the back-stress effect can significantly reduce the difference between the calculated values of minimum stresses and real laboratory values.

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