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Dynamics of the hydraulic fracture propagation in the laboratory experiment.

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Hydraulic fracturing is one of the most effective methods for increasing the productivity of hydrocarbon field development. The method consists in a highly conductive fracture creation by pumping fluid into the well under pressure exceeding the strength of the rock. Due to continuous fluid injection, the fracture growths. Inevitably, all the models of the hydraulic fracturing have some restrictions and their parameters can only be estimated by experimentation. The experiments in the real underground conditions are expensive and hard to conduct, so, usually the experiments have to be done in laboratories on the samples of the real rocks or on artificial samples.
The results of the laboratory experimental study of the hydraulic fracture propagation rate are considered. The laboratory experiments were carried out on artificial porous saturated samples in accordance with similarity criteria under true 3D loading. The fluid pore pressures were measured in 15 points of the samples; the strains were measured on the surface of the samples. The hydraulic fracture rate was determined by direct measurements as well as by indirect methods. The direct method was based on registering the change of the conductive strips resistivity. The first indirect method was based on the pressure variation measurements; the second one was based on a numerical solution of the problem of hydraulic fracture propagation. Special experiments were conducted, in which the injection pressure was made lower than the fracture opening pressure and it was supported on the same or varied values during long time (up to a day). The fracturing fluid injection under low pressure resulted in the fracture growth with low rate.
The experimental results and considered numerical model allow to get better understanding of the hydraulic fracture behavior under complex conditions of both stress and pore pressure change due to oil field development.