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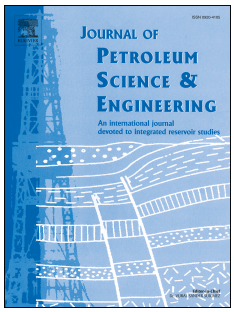


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# Experimental of hydraulic fracture propagation using fixed-point multistage fracturing in a vertical well in tight sandstone reservoir

Yuwei Li[a,b,*], Shuai Yang[a], Wanchun Zhao[a], Wei Li[a], Jun Zhang[a]
a. Department of Petroleum Engineering, Northeast Petroleum University, Daqing China 163318;
b. Harold Vance Department of Petroleum Engineering, Texas A&M University, College Station TX 77843
* Corresponding author: liyuweibox@126.com

**Abstracts:** Fixed-point multistage fracturing can effectively increase the stimulated reservoir volume (SRV) in tight sandstone reservoir. In different geological and engineering conditions, how to explain the geometric form of fracture propagation in fixed-point multistage fracturing has not been reported yet, and the propagation mechanism of hydraulic fracture is ambiguous. To clarify this mechanism, fourteen large-scale triaxial tests were deployed in this study to investigate the fracture propagation behavior in fixed-point multistage fracturing, and the influences of various factors on fracture geometries were studied. The results show that there are six types of fractures in the horizontal plane when the fixed-point multistage fracturing are carried out in a vertical well in tight sandstone reservoir: bi-wing planar fracture; bi-wing non-planar fracture; L-type fracture; X-type fracture; bi-wing turning fracture and re-orientation turning fracture. Fixed-point multistage fracturing can increase the SRV mainly because it is equivalent to carry out refracturing in the reservoir, so it can form a complex fracture system similar to refracturing. The research proves that it is difficult to form a complex fracture system through the fixed-point of multistage fracturing when the stress difference is more than 6 MPa in the horizontal direction. The fracturing fluid injection rate has an obvious effect on the formation of multi-fractures, and the multi-fracture can not form when the injection rate is too large. The enhancement of rock heterogeneity will lead to more energy consumption in fracturing process, which is not conducive to the initiation and propagation of fractures. Therefore, the in-situ stress, rock heterogeneity, injection rate and other factors should be comprehensive considered when designing the fixed-point multistage fracturing scheme for vertical well in tight sandstone reservoir.

**Key words:** tight sandstone reservoir; fixed-point multistage fracturing; fracture propagation; fracture geometry

## 1 Introduction

The development and utilization of unconventional oil and gas resources such as shale gas, tight oil and coal bed methane have become very important in the petroleum industry (Xu et al., 2018, Li et al., 2016a, Li et al., 2016b, Li et al., 2017, Li et al., 2018a, Li et al., 2018b, Li et al., 2018c, Rui et al., 2018a, Rui et al., 2018b). The successful development of shale gas has benefited from the application of large-scale fracturing, which has been widely used in the