

PROCEEDINGS

A Laboratory Study on Dynamic Propagation of Hydraulic Fractures in PMMA

Zhi-hai Wang^{1,*}, Feng-yun Sun^{2,*}, Yun-yu Zhou¹, Peng-yu Zhang¹, Qi Huang¹, and Tao Mei¹

¹College of Petroleum, China University of Petroleum-Beijing at Karamay, Karamay, 834000, China

²School of Engineering, China University of Petroleum-Beijing at Karamay, Karamay, 834000, China

*Corresponding Author: Zhi-hai Wang; Feng-yun Sun. Email: wangzh@cupk.edu.cn; sunfengyun@cupk.edu.cn

ABSTRACT

Hydraulic fracturing is a critical technology for reservoir stimulation and rock mass pre-treatment in engineering applications. However, controlling the morphology of hydraulic fracture propagation remains a challenge, due to the fact that its underlying mechanisms are not fully elucidated. To address this, hydraulic fracturing experiments were conducted using a non-porous material, polymethyl methacrylate (PMMA). A high-speed camera system was employed to capture the complete dynamic evolution process from fracture initiation to propagation. This laboratory experiment documented a series of phenomena associated with fracture propagation, including fracture initiation, propagation, deflection, fluid lag (fracture area exceeding the fluid-invaded zone), and backflow. The effects of parameters such as fracturing fluid, loading, and injection volume on the dynamic propagation of fractures were analyzed. Furthermore, the fracture propagation velocity in PMMA was further investigated. These findings provide valuable guidance for fracture control and parameter optimization in deep reservoir volume fracturing operations.

KEYWORDS

Hydraulic fracturing; transparent materials; dynamic propagation; fracture morphology

Acknowledgement: The authors acknowledge the assistance of the laboratory staff in experimental data collection.

Funding Statement: This work is supported by the Xinjiang Autonomous Region Tianchi Talent Introduction Plan (2025) and the General Projects of the Natural Science Foundation of Xinjiang Uygur Autonomous Region under Grant No. [2025D01A154].

Conflicts of Interest: The authors declare no conflicts of interest to report regarding the present study.



Copyright © 2026 The Author(s). Published by Tech Science Press.
This work is licensed under a Creative Commons Attribution 4.0 International License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.