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The Experimental Study of Hydraulic Fracturing Propagation in Multi-Layer Formations

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SUMMARY

The study deals with the interaction between hydraulic fractures with the layer interfaces, fracture propagation pattern, and termination in multi-layered media. A true tri-axial cell was utilized to conduct experimental tests on cubic multi-layered samples with discontinuities. The tests were also aimed to investigate propagation of fractures from soft to stiff, stiff to soft media through changing the elastic properties of rocks. Results showed the condition of discontinuities (bonded, unbonded, and filled) and elastic properties of layers influence the geometry and propagation pattern of hydraulic fractures. In the block with bonded interfaces, the fracture penetrates in the adjacent layers. However, in the block with unbonded interfaces the fracture propagates toward the interface, then after the injected fluid fills the interface, a new fracture will propagate in the adjacent blocks. In the sample with infilling material, the fracture propagation is arrested, subsequent to which the fluid begins to seep through the interface. In addition, the results reveal that immediately after the fracture reaches the interface, the pressure increases, and more pressure is needed for fracture to propagate across the interface. The study displays that the fracture width and its penetration length in soft layers are greater than those in stiff layers.

Abstract:

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Key words: hydraulic fracturing, layered formation, fracture propagation, Experimental investigation