

Experimental Observation of Injection Rate Influence on the Hydraulic Fracturing Behavior of a Tight Gas Sandstone

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Abstract

It has been widely accepted in hydraulic fracturing that the higher the pressurization rate, the higher the breakdown pressure. However, linear elastic fracture mechanics (LEFM) suggests the opposite. In an effort to clarify this “injection rate paradox,” three controlled laboratory hydraulic fracturing experiments were conducted using different injection rates. These tests showed that the higher the injection rate, the lower the breakdown pressure. Further investigations indicated that the elastic- and poroelastic- models were not able to properly predict the observed breakdown pressures. Using Griffith’s energy balance concept, an LEFM-based breakdown pressure model was derived which gives satisfactory predictions.