

Integrated Model for Proppant Selection Optimization

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The purpose of hydraulic fracturing is well stimulation by which the well performance can be significantly improved. To achieve this, a high conductive fracture is created which is propped with a propping agent. The success of the treatment is highly influenced by the fracture conductivity which is the product of the apparent proppant pack permeability and the fracture width. The well productivity after hydraulic fracturing is definitely affected by the interaction between proppants and fracture surface under closure pressures, the proppants embed into the formations and deform due to the closure stress that can result in a significant reduction in fracture conductivity.

Proppant size, Young's modulus and Poisson's ratio of proppant and formation, closure pressure are factors which influence proppant embedment and the change of fracture aperture that actually can reduce the fracture conductivity from 20 to 300 % with a subsequent reduction in oil, gas or even in water production (geothermal wells). This effect in weakly consolidated formations is more significant. Therefore, it is of importance to investigate and understand the theoretical background and the influencing parameters of proppant embedment.

Companies and experts in the field, especially the project managers are interested in the return of the projects. The pay-off of the hydraulic fracturing treatment is significantly affected by the well productivity. In this study, more models and considerations were integrated to develop a new analysis system by which different sensitivity tests (with deep consequences) and a kind of technical optimization of proppant selection can be executed. Ignoring any costs or revenue (CAPEX, OPEX, NPV, etc.) calculations, the outcome of this research provides a method for proppant selection considering not only the factors that influence fracture conductivity but another optimization method, the so-called Unified Fracture Design (UFD) model as well.