DGMK/ÖGEW-Frühjahrstagung, Fachbereich Aufsuchung und Gewinnung
Celle, 25./26. April 2019

DGMK-Project 814: Numerical and Model-Physical Investigations on Innovative Frac-Technologies with Alternative Frac-Fluids for Tight Gas Formations and Re-fracturing Options

M. Z. Hou[*/**/***], F. Mehmood[*/**], J. Liao[*/**]
*Research Centre of Energy Storage Technologies, TU Clausthal
**Institute of Petroleum Engineering, TU Clausthal
***Energy Research Centre of Lower Saxony (EFZN)

Abstract

The urge to increase the petroleum production to meet the current and future energy demand is ever increasing. The commercial production from unconventional reservoirs is a key to the future of energy secure and stimulation especially hydraulic fracturing is the mainstay for their exploitation. To overcome the discrepancies of widely used water-based fluid fracking operations both technically and environmentally, fracking with innovative waterless frac-fluid is proposed. The investigation into innovative waterless frac-technologies will not only improve the recovery efficiency but will also pave the way for general public acceptance towards fracking operations. The characteristics such as existence in liquid phase at normal surface conditions and phase change to gas upon flowback are vital for the alternative fluid. This will result in a quicker cleanup of frac-fluid and better proppant placement, making it suitable especially for highly tight and ultra-tight formations. To numerically simulate the fracturing and flow ability of innovative frac-fluids, the development of multi-phase multi-component full 3D fracture and flow model is necessary and crucial for the success of alternative frac-fluid technologies. The proposed solution, however, lies in the development of coupling the in-house upgraded version of FLAC3D known as FLAC3D^{plus} (full 3D thermo-hydromechanical (THM) coupled rock mechanical simulator) with TOUGH2MP/TMVOC (numerical simulator for multi-phase and multi-component flow). The new developed numerical model will not only be able to simulate the complete hydraulic fracturing job with alternative frac-fluids, but will also have the capability to perform the matrix and fracture flow simulations for compressible, slightly compressible and highly compressible fluids in the pore space simultaneously. Overall, this research work will be valuable in developing better exploitation techniques for unconventional particularly tight and ultra-tight reservoirs.