Contribution ID: **292** Type: **Poster**

Research on stress sensitivity of fractured carbonate reservoir by CT Technology and pore-scale simulation

Wednesday, 16 May 2018 18:30 (15 minutes)

Fractured geological formations are ubiquitous throughout the world, and their stress-sensitive behaviors are of primary interest in a number of contexts. In this study, a stress sensitivity experiment on carbonate core plugs in which micron Computed Tomography (μ-CT) technology is applied to visualize and quantitatively evaluate morphological changes to the fracture aperture with respect to confining pressure. Fracture models were obtained at selected confining pressures on which pore-scale flow simulations were performed to estimate the equivalent absolute permeability. The results showed that with the increase of confining pressure from 0 to 0.6 MPa, the fracture aperture and equivalent permeability decreased at a greater gradient than their counterparts after 0.6 MPa. This meant that the rock sample was more stress-sensitive at low effective stress than at high effective stress. On the loading path, an exponential fitting was found to fit well between the effective confining pressure and the calculated permeability. On the unloading path, the relationship was found partially reversible, which can evidently be attributed to plastic deformation of the fracture as observed in CT images.

References

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Session Classification: Poster 3

Track Classification: MS 1.24: Pore structure characterization and micro-scale effect on fluid flow in unconventional reservoir