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Numerical Modelling of Reactive Flow and Wormhole Formation in Carbonate Rocks

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Many subsurface operations –such as drilling, cementing, well completion, and production –can result in damage to the rock formation near the wellbore, decreasing the permeability and resulting in a reduction in oil or gas production. Acidizing is one type of treatment that is employed to increase the permeability around the wellbore. In carbonate rocks, acidizing can not only reduce the damage, but it also can create conductive channels that extend some distance into the rock mass, known as wormholes, whose hydraulic conductivity is several orders of magnitude larger than that of the porous medium. Moreover, the experimental observation has shown that the amount of acid required to breakthrough is minimum when wormhole dissolution is formed. Therefore, simulating the reactive flow in carbonate medium and finding the optimum injection rate are of fundamental importance to reduce the acidization cost. In this work, a two-scale continuum model is improved and extend to the 3-D radial flow condition, and used to simulate reactive flow and wormhole formation in carbonate rocks. Then, combining the two-scale continuum model and the discrete fracture network model, a continuum model is developed that is used to examine wormhole formation in cases with single and multiple fractures, including characteristics such as fracture orientation, pattern and aperture. Because of the positive feedback associated with fractures, the simulation results indicate that the flow+dissolution process typically uses only some of the available fracture pathways.

References

- [1] Panga M K, Ziauddin M, Balakotaiah V. Two-scale continuum model for simulation of wormholes in carbonate acidization[J]. AIChE J, 2005, 51(12): 3231-3248.
- [2] Kalia N, Balakotaiah V. Effect of medium heterogeneities on reactive dissolution of carbonates[J]. Chem Eng Sci, 2009, 64(2): 376-390.
- [3] Maheshwari P, Ratnakar R R, Kalia N, et al. 3-D simulation and analysis of reactive dissolution and wormhole formation in carbonate rocks[J]. Chem Eng Sci, 2013, 90(0): 258-274.
- [4] Liu P, Yao J, Couples G D, et al. Numerical modelling and analysis of reactive flow and wormhole formation in fractured carbonate rocks[J]. Chem Eng Sci, 2017, 172: 143-157.
- [5] Liu P, Yao J, Couples G D, et al. Modelling and simulation of wormhole formation during acidization of fractured carbonate rocks[J]. Journal of Petroleum Science and Engineering, 2017, 154: 284-301.
- [6] Walle L, Papamichos E. Acidizing of hollow cylinder chalk specimens and its impact on rock strength and wormhole network structure[C]. 49th US Rock Mechanics/Geomechanics Symposium, 2015.

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