Modeling and Simulation of Gas and Water Flow in Tight Fractured Porous Media

Abdelaziz Khlaifat[1,*], Hani Qutob[1], and Hamid Arastoopour[2]
[1]*Weatherford Oil Tool Middle East Ltd., Dubai, UAE*
[2]*Department of Chemical and Biological Eng., Illinois Institute of Technology, Chicago, USA*
***Corresponding Author:** abdelaziz.khlaifat@me.weatherford.com*

The considered porous media in this paper belong to gas reservoirs characterized by a low permeability matrix and high permeability fractured system. The mathematical model differentiates between two flow regions, one representing the discrete matrix and the other representing the continuous fracture network. Fracture is characterized by a much smaller volume than the pores (low storage). The model utilization was demonstrated by solving a three-dimensional isothermal transient two-phase flow of gas and water in a low permeability porous media which has been developed from the general conservation laws of mass and momentum. Darcy's and nondarcy's laws were incorporated into the equations to couple them by a fluid transfer term which depends on the potential difference between the two specified regions. The specific problem to which the numerical solution was applied assumes a single horizontal fracture perpendicular to the flow direction in a quite small geometry. Accounted for are fluid incompressibility and immiscibility, the effect of capillary pressure and relative permeability. A numerical solution was obtained using the modified CFX-Flow3D code. The simulation was applied to some obtained results in the laboratory experiments and predicted two-phase flow behavior. Calculated two-phase flow rates reflect the sensitivity of fluid flow to gas and liquid permeability in tight porous media. Also the results indicated that the multilayer reservoir provides a better estimate of post-fracture performance compared to a more conventional, single-layer reservoir description.