INVESTIGATION OF WORMHOLE PENETRATION IN CARBONATE ROCKS UNDER HIGH PRESSURE

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Abstract

Matrix acidizing is a classic stimulation technique through which the permeability of a formation is altered by injecting an acid which result in dissolution of rock. In carbonate reservoirs, this process actually creates flow channels for the hydrocarbons in the near wellbore area known as “wormholes”. The objective of this project was to study the phenomenon of “wormholing” in deep carbonate formations at high pressure.

The primary focus was to establish good understanding of the rock dissolution under high pressure and moderate temperature conditions for tight reservoirs. There are various parameters involved in such studies which include but not limited to the flow rate of acid, the concentration of the acid, rock type, rock properties, temperature and pressure. There have been vast studies reported in the literature; however, experiments with such high pressures have not been conducted before.

In this project, we studied the propagation of wormhole by conducting experiments using new coreflooding system capable of handling high pressure and longer cores. These experiments provided new insights regarding the phase of CO₂ on the process of wormholing at different pressures. On contrary to the assumptions in the modeling, CO₂ was found to be at gaseous state moderate pressures, hampering the process of wormholing. With abundant data from coreflood experiments, the effect of pressure and flow rate studied. The long cores used in the experiments along with the special setup on
the coreflood system helped us to establish relation between the length of the core and the dissolution. It was found that length plays an important role when the pressures are moderate. Description of wormhole speed and wormhole diameter profile at different conditions has been covered in detail. CT scans, thin section and SEM were used to understand the shape and propagation of the wormhole morphology.