

Gaps and Challenges for Light and Tight EOR

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Abstract

In the Western Canadian Sedimentary Basin (WCSB), abundant tight and light oil resources are locked in formations such as Bakken/Exshaw, Viking, Cardium, and Lower Shaunavon. While new tight oil wells are highly productive when stimulated through hydraulic fracturing, this production declines rapidly from its initial peak, at rates sometimes in excess of 85% per year and with ultimate primary recovery of only 3 to 10% of the original oil in place. Innovation related to multi-stage hydraulic fracturing in horizontal wells has proven to be the key factor of the boom in the development of the light and tight oil fields over the last decade. Technology advancements enable oil producers to increase recovery factors while lowering decline rates, capital and operating costs. Even in the current price environment, light and tight oil formations are among the most economic oil plays in North America. However, many gaps remain and significant work is needed to grow or even sustain the current level of production. Because of the micro- to nano-meter-scale flow channels in tight oil formations, their phase behaviour and multi-phase flow could be significantly different from those in conventional oil reservoirs. In general, tight oil reservoirs are characterized by large local variations in permeability, lithology, and mineralogy. This is further complicated by fluid flow and mass transfer between the matrix and fractures with extreme permeability contrast. Most significant challenges include limited injectivity, poor reservoir contact, exacerbated relative permeability effects (water or gas saturation blocking), high chemical adoption and water sensitivity due to large surface area and high clay content (particularly in the Viking formation), and difficulty in reservoir and fracture mapping and characterization. This is particularly challenging when conventional EOR methods are applied to the light and tight oil fields. Re-fracking is a popular method of reversing the sharp productivity decline but it is still poorly understood. This presentation reviews the state of art in IOR and EOR techniques in light and tight oil reservoirs, focusing on the gaps and challenges in our understanding of various mechanisms and processes important for the most popular techniques of improved oil recovery in tight reservoirs, such as waterflooding, gas flooding and chemical flooding.

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