TAM INTERNATIONAL

Optimizing Steam Injection in Heavy Oil Reservoirs
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Abstract
For a number of years one of the main areas being developed has been unconventional reservoirs. Much of the attention has been given to shales, or extremely tight reservoirs, that require multi-stage fracture treatments. One tool that has helped exploit this type of reservoir has been swellable packers. Formations which contain heavy oil are another source of unconventional reservoirs. Heavy oil is recovered by introducing heat into the reservoir through thermally controlled processes. Injecting steam is the most typical way to heat up the rock so that the oil will flow. One of the greatest challenges in operating an efficient steam project is having control of where the steam is going. Accurate steam placement is essential to achieve economical recovery volumes. Many dollars are wasted by poor steam injection management.

A high temperature water swellable packer has been developed to help optimize production in cyclic steam stimulation and Steam Assisted Gravity Drainage (SAGD) applications in heavy oil reservoirs. The packer allows uniform or selective placement of steam along the entire length of the horizontal section of the wellbore, and is designed to handle high temperatures (575º F (302ºC)) and the moderate pressures associated with steam injection. In most wellbores either screens or slotted pipe are run to allow the steam to be pumped between the two wells. If the slotted pipe or screens in the production well are damaged, uncontrolled steam and sand are produced, which creates problems. The swellable packer can be deployed as part of the production liner or screens to provide zonal isolation. In the event of steam breakthrough, the zone affected can be selectively shut-off using a swellable scab liner, thus allowing efficient hydrocarbon recovery without the threat of injected steam and sand being produced or the need to shutdown production to cool the reservoir.

Isolating and controlling steam placement is critical to profits and safety. Steam that is injected and finds its way to surface due to poor annular isolation not only will shut down a project, but presents a tremendous safety and environmental concern. Achieving annular isolation has typically been attempted using cement. The casing was then perforated to provide a path for the steam to be injected into the formation. Not only does cement lose integrity at high temperatures, but injecting steam through perforations is not optimal for most steam recovery projects. A horizontal well completed with a slotted liner provides a superior method for injecting steam into the formation. For a non-cemented slotted liner at temperatures as high as 575º F (302ºC) there are few options for achieving annular isolation required for effective injection over the length of the lateral.

This paper presents a solution to repairing one leg of a SAGD well as well as the challenges of developing and manufacturing a swellable packer that has an elastomeric seal that remains elastomeric after long periods at steam injection temperatures and also addresses pipe movement issues at these temperatures. Every operator is coming across new learning experience almost every day, although most of this information is proprietary, we are proposing a different solution path to overcome some of these issues.

Complete paper