UNCONVENTIONAL RESOURCES

Channel Fracturing

Schlumberger’s stimulation technology aims for higher production and recovery rates

IN THE FIERCELY COMPETITIVE world of unconventional oil and natural gas production, operators are constantly on the lookout for any new technologies that can help to provide that extra edge.

Among those technologies is Schlumberger’s new HiWAY flow-channel hydraulic fracturing technique, which improves the ability of a fracture to deliver increased oil and gas production. “It’s a technique that changes radically the way in which we generate conductivity within a hydraulic fracture,” says Alejandro Peña, worldwide well stimulation product champion for Schlumberger.

The technique decouples fracture conductivity from proppant pack permeability by creating stable flow channels. Instead of flowing through the proppant pack, hydrocarbons flow through these channels, significantly increasing conductivity. The network of channels extends from the near-wellbore region to the tip of the fracture. It allows for longer effective fracture half-lengths, lower pressure drops along the fracture, and better fluid and polymer recovery, all of which contribute to optimized production and hydrocarbon recovery. Schlumberger has seen a consistent trend across the board, with increases typically exceeding 25 per cent, says Peña.

A number of related and interdependent elements contribute to the success of the technology, according to Peña. These include a specialized pumping technique, advanced fibre technology, completion strategy (placement of perforations) and engineering modelling.

Schlumberger uses its specialized blending equipment and control systems to pump proppant in pulses at a high frequency within the fracture. The proppants help hold the fracture open, serving as “columns” for the channels to be developed around them.

The fibre plays several roles, including helping to keep the proppant pulses cohesive, preventing them from spreading as they travel through the surface lines and down into the completion. The fibre also helps to improve the carrying capacity of the fluid-proppant-fibre mixture, making it easier for the fluid to transport the proppant pulses. Thirdly, the fibre helps keep the pulses suspended within the fracture, preventing them from settling while the fracture closes.

The engineering modelling ensures that the HiWAY fluid is being pumped at the right rate with the right pulse duration and with the right proppant concentration to deliver open channels.

The most important aspects of the technique are modelling and engineering, says Peña. A geomechanical model was developed specifically for the application and is now incorporated in Schlumberger’s fracture design tools. The proprietary Schlumberger FracCADE fracturing design and evaluation software is currently the only design software in the industry that is able to predict the formation of

A BETTER FRAC

HiWAY flow-channel hydraulic fracturing technique shown on the right, as compared to conventional fracturing on the left.
channel fractures in the way that it is done by HiWAY, he says.

Schlumberger qualifies a reservoir for the use of the technique. The company runs the reservoir properties through its software tool, generating a fracturing proposal that tells the customer whether it should expect to generate channels within the fracture and what kind of conductivity those channels would generate.

The key in determining reservoir suitability for the technique is rock competency. Although most reservoirs are suitable for the HiWAY technique, there may be some cases in which the rock will not be stiff enough to support a network of open channels, according to Peña. In those cases, the engineering tools will provide the necessary warnings.

HiWAY has been used with success in both oil and gas reservoirs with a wide range of lithologies including carbonates, sandstones, shale/carbonate mixtures and shale/sandstone mixed formations. It also has been pumped with temperatures ranging from 140 F to 325 F.

The project was launched in 2003, with the first field testing in 2007. “All those years were devoted to developing the engineering principles and the technology that allow us to deliver the HiWAY service,” says Peña.

HiWAY was commercialized last June and “the take-up of the technology has been impressive,” he says, with 520 of the total 550 jobs taking place since then. Although most of the jobs have been in United States Rockies and southwest Texas, the technique also has been used on jobs in Mexico, Argentina and Russia.

Schlumberger has plans to introduce HiWAY into Western Canada this year and currently is evaluating several candidate formations.

In addition to increased production, the HiWAY technology offers a more reliable placement of fracturing materials, according to Peña. “It provides customers with the confidence that they will be able to place the job as designed,” he says.

So far there have been no reports of “screenouts” due to this technique, in which the stimulation ends prematurely because the formation can no longer take in any more fluid. The operator typically ends up with a wellbore full of proppant and fluid that needs to be cleaned out before the well can be put on production.

Houston-based Petrohawk Energy Corporation is one of the companies that last fall implemented the technique on a select number of wells as a trial to determine the impact on horizontal multistage production in the Eagle Ford shale.

Initial production results from the limited set of wells in the Hawkville field reflect average production increases of approximately 37 per cent in the areas with gas and natural gas liquids and an average of approximately 32 per cent in the high condensate yield areas, the company reported.

Based on internal estimates for the limited trial, Petrohawk says that the estimated ultimate recovery increased by between 25 per cent and 90 per cent compared to offsetting wells completed with conventional fracturing techniques. The company says it has converted 100 per cent of the frac services provided by Schlumberger in the Eagle Ford to HiWAY. •

Elsie Ross