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Marcellus Field Study: Application of Viscoelastic Surfactant Stimulation System for Shale

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Abstract

Hydraulic fracturing treatments have been successful in stimulating low permeability shale reservoirs by enhancing the reservoir contact area. In the Northeastern United States, the Marcellus shale, like many other shales, is typically hydraulically fractured using friction-reduced water (slickwater). Without any additional additives, the low viscosity slickwater fluid has poor proppant transport qualities, which can result in accelerated proppant settling and limited proppant distribution into the hydraulic fracture network. As a result, guar polymer is often added to the stimulation fluid at the conclusion of the slickwater treatment to viscosify the fluid, thereby allowing for improved transport of higher proppant concentrations that will enhance the near-wellbore fracture conductivity. While the polymer-based fluids can effectively transport proppant into the fracture, any residual guar present within the induced fracture can significantly reduce the retained fracture proppant-pack permeability and damage the formation face. These damage mechanisms must therefore be properly addressed during the fluid system design phase to prevent adverse effects to the production performance of the well.

This paper details the results of a completion and production design study which was performed using a state of the art reservoir-centric stimulation design platform. The study set out to define the optimum fluid characteristics required for improved production taking into consideration the obstacles previously described above. To address these challenges, a recently developed polymer-free viscoelastic surfactant (VES)-based fluid system was modeled to understand the effect of enhanced proppant transport and reduced formation damage on well productivity.

From the modeling efforts, a field implementation program for the VES fluid system was successfully conducted in the Marcellus shale. This fluid was pumped for the first time in May 2012 and has since been applied to over twenty wells within the basin. The results of this trial revealed operational advantages over the traditional fluid systems related to both surface efficiencies as well as treatment placement. Initial production results have allowed for calibration as well as validation of the fracture and production models thereby paving the path forward for further optimization of the completion program.