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Long Term Evaluation of an Innovative Acid System for Fracture Stimulation of Carbonate Reservoirs in Saudi Arabia

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Abstract

Acid Fracturing has been a successful method to stimulate the Khuff Carbonate wells of Saudi Arabia since the beginning of the gas development program. Various types of acid systems including conventional, emulsified and surfactant-based have been used in an attempt to achieve optimum fracture length and conductivity. Acids used for these treatments have been typically formulated with 28-wt% HCl and have been used successfully to increase production from the Khuff carbonates.

Although acid fracture treatments create significant conductivity enhancement in treated wells, their etched fracture length is typically short because of the high speed at which acid spends upon contact with the high temperature reservoir. The quest to increase the effective half-length of the fracture and enhance production led to the search for novel effective technologies capable of achieving this goal. One such technology is the solid acid system which was field tested for the first time in the world in a Saudi Aramco gas producer. The material is pumped as an inert solid, which hydrolyzes and converts to acid when exposed to water and heat resulting in heterogeneous etching and increased conductivity. Among the key factors supporting a field trial of the product was the fact that it offered the prospect of overcoming the traditional challenges that are always associated with acid fracturing such as excessive acid leak-off, shallow acid penetration, fast spending due to the temperature effect and corrosion. However, a solid acid system also reduces the health, safety and environmental (HSE) risk caused by conventional acid exposure to both personnel and production equipment. Placement of this material in the Khuff was a significant challenge due to the high fracture gradients encountered in this complex reservoir. Previous attempts to place proppant in other wells with similar reservoir characteristics resulted in premature screenout. Nevertheless, the first worldwide field trial of the new technology was successfully implemented.

This paper will discuss in detail the design, execution, post-stimulation and the long term results from this first trial. It will also provide conclusions and recommendations on the effectiveness of this novel technology and suggest areas of improvement that will help in promoting a step change in acid fracturing industry worldwide.