SURFACE MODIFICATION OF PROPPANT TO IMPROVE TRANSPORT AND PLACEMENT

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ABSTRACT
Slick water hydraulic fracturing treatments are the preferred method for stimulation of tight hydrocarbon plays as these treatments enhance the complexity of fracture networks, increase fracture lengths, reduce formation damage and decrease treatment costs. These characteristics of a slick water treatment are critical to produce economic wells in unconventional formations. Even though these treatments are effective, they also have disadvantages that can limit production and increase treatment costs. With slight modifications to the treatment design of traditional slick waters - the addition of a novel chemical and 5% nitrogen - the limitations can be reduced.

The performance of the slick water treatment is improved by modifying the proppant’s surface properties. A novel surfactant preferentially adsorbs onto the surface of the proppant (for both quartz and ceramic), hydrophobically modifying the surface of the solids. The enhanced surface properties create an attraction between the proppant surface and nitrogen gas, in effect, surrounding the particle with a thin layer of gas and thus increasing the buoyancy of the proppant in water. These enhanced properties allow for improved proppant distribution, deeper proppant penetration within the complex fracture network, increased proppant pack volume, and increased maximum proppant concentration that can be placed. Improving proppant placement and increasing the volume that the proppant occupies within the fracture enhances the conductivity of the fracture network, therefore improving the productivity of the well.

Laboratory studies of polymer adsorption, sand pack column flow analysis, crush resistance and brine compatibility testing will be presented to complement laboratory analyses previously published. Case studies of field treatments will also be provided. The first case study uses pad wells and compares the new system to traditional fracturing fluids. It will show that, without changing any other variables in the treatment design, production is enhanced significantly. The other two case studies will illustrate how production has been increased in two formations in the Western Canadian Sedimentary Basin.

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