

Alternative Stimulation Diversion Techniques for Unconventional Carbonate Source Rock in Saudi Arabia

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ABSTRACT

Unconventional reservoirs require maximizing the stimulated reservoir volume in order to enhance the well production. One of the well-known industry solutions is to increase cluster density within available lateral. Stimulating more clusters per stage improves efficiency and lowers the costs but could stand as a challenge if clusters are unequally stimulated. The stress difference, perforation tunnels and near wellbore frictions dictate the flow or treatment path. This paper presents internally developed solutions to address challenges of frac initiation and propagation to achieve adequate production contribution from all clusters along the lateral. It is very difficult to effectively stimulate all clusters in wells landed horizontally in highly tectonic and heterogeneous unconventional source rock. Even with limited entry technique and high rates applied to divert frac fluid to all clusters there are still challenges to reach required downhole pressure to breakdown the rock in all clusters. The treatment fluid will choose the path of least resistance leaving unstimulated area, in this case clusters with high near well bore friction or located in high stress zones are not treated if fracture was already created in weaker sections of the stage. Single Acid spearhead is typically pumped before main treatment in carbonate source rock, even though it helped reducing treating pressure and reach required pumping rate it is not effectively stimulating all clusters. Splitting the acid spearhead and introduction of viscous fluid between acid stages before main treatment, is proven to reduce treatment pressure and increase pumping rate, but more importantly help effectively divert frac fluid into all clusters and achieve proper stimulation of all clusters. This became of great importance when number of clusters per stage were increased. The technique successfully applied over 250 stages in similar reservoir condition and similar completion observed almost 1000-1500psi pressure drop at each acid stage allowing rate significant increase. This effectiveness of this technique is measured by: - Pressure drop when each acid stage hit perforation indicating new clusters are being opened - Achieved rate and measured surface pressure is an indication of number of cluster open - Comparison of the results with conventional technique