Development of a Novel Phosphonate Scale Inhibitor for Scale Control in Various Harsh Environments

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The challenges of scale inhibition faced by the oil industry are continuously changing as well as the chemical requirements associated with scale inhibition. When selecting a scale inhibitor there are a number of factors and limitations that will influence the chemistry chosen for each application and often there is not one chemical that is fit for purpose for scale control under both conventional and high temperature conditions. A novel phosphonate chemistry has been developed which bridges the performance gap between different phosphonate products to be applicable over a wide range of scaling conditions. In addition, this product can also be easily be blended with other chemicals like H_2S scavengers.

This study is focussed on the development of a multifunctional, biodegradable, calcium tolerant and thermally stable scale inhibitor that can be used for a variety of applications including topside through continuous injection, downhole via capillary application and also scale squeeze treatments.

The new phosphonate scale inhibitor has been designed to work for the three most common types of scale; calcium carbonate, calcium sulphate and mild to moderate barium sulphate and examples of these will be provided. Furthermore, for calcium carbonate, details will be provided of scale inhibition performance testing in a geothermal brine at 250°C, where the new phosphonate chemistry demonstrated significant improvements compared to other phosphonates and polymeric scale inhibitors known to be stable at high temperature.

Field examples will be also discussed including data from a high calcium brine in West Africa (30,000mg/L), where the chemical has been deployed via downhole capillary injection and for continuous topside injection in a North Sea field where this chemistry was used in combination with H_2S scavenger.

This paper discusses the development of a novel, biodegradable phosphonate scale inhibitor and highlights the potential multiple uses of this chemistry in a variety of challenging environments.