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Enhanced Steel Alloys Outperform Typical Bottom Hole Assembly Chemistries in Sour Service Applications

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Abstract

Many of today's aggressive drilling programs require well construction through sour formations to reach remote reservoirs. This has exposed limitations of traditional steel chemistries used for bottom hole assembly (BHA) components. For many years, the industry has used traditional API materials in environments with low concentrations of hydrogen sulfide (H_2S) and carbon dioxide (CO_2). Higher temperature and low stress level conditions in the deeper portion of the well have allowed for these BHA materials to operate adequately with few issues. However, the drive to drill in more corrosive environments has increased the need to develop materials more aptly suited for harsh sour service conditions.

To date, standardization bodies such as API and ISO do not provide specifications for the manufacture of sour service drill stem components. Consequently, organizational bodies such as the IRP in Canada are developing their own requirements for sour applications. The stringent requirements and improved mechanical properties required for sour applications prompted the industry to move away from API materials.

This paper will present test results comparing standard API material and several alloyed variations. Results indicate that the alloyed variations show a slight increase in resistance to hydrogen sulfide under low level concentrations while under higher concentrations; the materials show little to zero improvement. This paper will also present emerging alloying technology and enhanced heat treatment processes that have yielded materials exceptionally suited for aggressive sour applications. These materials exhibit excellent resistance to sulfide stress cracking (SSC) and have been successfully used in some of the most severe corrosive environments in the world (also presented). These enhanced BHA materials will significantly improve drilling efficiency by eliminating the risk of failure due to H_2S and CO_2 exposure.