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To boost drillstring life, hardbanding reapplication specs could be more critical than initial specs

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By Bob Miller, Postle Industries

As the drilling industry evolves to accommodate the challenges of deep-well and horizontal drilling techniques, increasing demand is being placed on the maintenance of drillstrings, particularly the tool joints.

Postle Industries' Duraband NC hardbanding wire, certified for both new applications and reapplications, can deposit a casing-friendly, non-cracking, rebuildable hardbanding.

As recently as 15 years ago, tool joints were adequately protected by tungsten carbide hardbanding. Because of the limited use of casing while drilling, casing wear was not an issue. As wellbores became deeper and more deviated, however, more casing strings were used, thus becoming a serious target for wear by the tungsten carbide hardbanding.

For the most part, tungsten hardbanding has been banned from drillstring hardbanding except on drill collars and heavyweight. This resulted in the industry relying more on traditional types of hardfacing alloys – at the sacrifice of tool-joint wear. Many of these alloys are considered "casing friendly" and do not wear out the casing prematurely. Many of the more effective alloys produced cracks due to the metallurgical structure of the hardbanding. These cracks often led to premature failures, spalling and other reapplication problems.

Fearnley Procter Group is a third-party inspection and specification group whose NS-1 new-application certification involves the application of a hardbanding product onto three tool joints that are sectioned and examined extensively via a crush test, micro hardness studies, etc. The product's procedure manual is also scrutinized by a committee, and a casing wear test is conducted. Certification is awarded after all criteria have been met.

Three years ago, Duraband NC hardbanding wire was introduced with the Fearnley Procter NS-1 new-application certification, which does not cover the product's reapplications over itself or over other hardbanding products. Reapplication procedures and specifications are critically important, perhaps even more so than new applications, because they're critical to the longevity and overall maintenance costs of drillstrings.

Recognizing this, **Postle Industries** achieved Fearnley Procter's reapplication certification in January 2010 for Duraband hardbanding.

Duraband is a metal-cored, gas-shielded welding wire that is capable of depositing a casing-friendly, non-cracking, rebuildable hardbanding. It is designed to maximize the wear resistance of tool joints while minimizing casing wear. It can be used with tungsten carbide additions to enhance the wear resistance of heavyweight and drill collars. The addition of tungsten carbide, however, renders this deposit non-casing friendly.

When wells used to be shallow and straight, it was common practice to drop tungsten carbide chips into mild steel weld puddles for tool joint protection. As wells became deeper and multi-directional, casing became the target for catastrophic wear by the tungsten carbide hardbanding. Tungsten carbide chips are recycled and crushed machine tools; therefore, they act as cutting agents when they come into contact with metal.

The industry quickly realized that these tungsten carbide chips wore through the casing in relatively short time, resulting in costly and time-consuming failures.

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Alternative alloys were considered for hardbanding that came into contact with casing. In the early 1990s, the Drilling Engineering Association (DEA) conducted a study (DEA 42) with the intent to categorize competitive hardbandings and their relationship to casing wear. Tests were conducted on the Maurer Engineering test apparatus. The results were published, and a 2.0 casing wear number criteria was established as a benchmark. Anything below 2.0 was considered "casing friendly," and anything above 2.0 was not casing friendly.

The Maurer test apparatus changed hands a couple of times, and it is now performing tests in the Mohr Engineering laboratories in Houston. The test and the standards have deviated greatly from DEA 42, and the resulting data differ greatly from DEA 42 results. No longer is the casing wear number of 2.0 considered the benchmark for casing-friendly hardbanding.

The casing wear test standards and procedures are being reviewed by API with the intent to publish a standard. The result of changes in the test has caused confusion and apprehension about what is considered to be a casing-friendly hardbanding. Until API concludes its review and publishes a specification, the industry is confined to their own interpretations of the Mohr Engineering Test data.

The casing-friendly attribute of Duraband comes from a test conducted at Mohr Engineering in Houston. During this test, the Duraband deposit was rotated against a standard casing material while sand-bearing mud was trickled down between the deposit and casing simultaneously. The material rotated at 155 rpm and was oscillated back and forth. A 3,000-lb/ft load was applied. The test ran for eight hours.

At the end of this test, a final wear scar depth measurement was made and determined how much metal had been removed. From this value and other parameters, a casing wear number was calculated. Low-value wear factors are considered desirable.

REAPPLICATION

Duraband can be applied over itself any number of times. Its procedural manual calls out exactly how worn hardbanding should be inspected and demonstrates the acceptable criteria. It also addresses serious defects such as large porosity, numerous porosity, cracking and spalling.

It's also not necessary to remove Duraband before reapplication over itself, providing that the worn hardbanding is free from gross defects incurred during drilling. Previously worn hardbandings should be scrutinized carefully for excessive cracking and gross porosity. Reapplications are only as good as the previously worn hardbanding's condition.

Typically worn hardbanding products return for reapplication displaying cracks. Careful examination should reveal any wide or deep cracking, which should be rejected. Cracks harbor a great deal of debris, which can affect re-application.

Bob Miller is materials engineer for Postle Industries.

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4 COMMENTS

Mark Juckett
Apr 30, 2010 at 1:44 pm

Mohr Engineering purchased the casing wear test machine from Maurer Technology and has made substantial improvements that offer more accurate test data. Recent testing being driven by major Operators such as Shell, Chevron and BP have increase side loads, oil and synthetic muds and high alloy casing samples that better simulate today's drilling environment.
Most hardband manufactures today have had multiple tests performed by Mohr Engineering as well as multiple NS-1 Certifications which expires every 2 years.
Reapplication without removal is standard with Tuboscope hardbandings also and has been for many

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