Finally, the truth about drill string hardbanding

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DRILL STRING hardbanding was introduced into the oilfield as early as the 1930s by **Hughes Tool Company**. At that time, and for many years afterwards, there was only what we know as "tungsten carbide" hardbanding. It consisted of a solid, soft steel wire being welded onto the box tool joint of drill pipe while simultaneously dropping tungsten carbide particles into the molten weld puddle. When it solidified, it left a raised, extremely hard surface above the tool joint that would significantly increase the life of the drill pipe.

In the early days of the oilfield, wells were relatively shallow (< 5,000 ft) and straight (< 2° deviation). As the industry began drilling deeper, they discovered wells became much more deviated. Next, they noticed well blowouts caused by wearing holes in their casing due to the tungsten carbide particles acting as a machine tool when it contacted the casing wall during drilling and tripping operations. Many changes were made to the design of hardbanding materials over the next 50 years, but the fact remained that whenever the tungsten carbide contacted the casing wall, it caused excessive wear, which eventually caused a blowout. Through the years, other types of hardbanding materials were developed but without much success. Therefore tungsten carbide remained the standard until 2000. Now, casing-friendly hardbandings, rather than tungsten carbide, have become the norm.

In the late 1980s, when highly deviated and deeper wells became more popular, it became imperative that another type of hardbanding be developed that would protect the casing and other drilling components. One of the first successful materials to come out was a high chrome composition that performed well in the casing protection phase. However, it had a short open-hole wear life and consequently wore the drill pipe tool joints below minimum dimensions within a short time frame. Over the last 15 years, many new hardbanding wires have been developed, but only a select few actually protect the drill pipe, the casing, the blowout preventors and the marine riser pipe at the same time. Most of the others protect one area or another, but not at the same time.

HARDBANDING WEAR TEST COMPARISONS

Name/Type	CW%	CWF	FF	Rad. HBW O/H In.	Rad. HBW Csg. In.
HB1	3.9*	0.74	0.17	0.018	0.0055
HB2	7.75	1.2	0.17	0.010	0.006
HB3	5.5	1.0	0.18	0.009*	0.0005*
Tungsten Carbide	21.5	7.6	0.15	0.014	0.000
Unhardbanded	17.5	5.5	0.20	0.043	0.004
HB4	6.5	1.3	0.15	0.023	0.008
HB5	7.8	1.3	0.18	0.015	0.006
HB6	7.0	1.2	0.18	0.023	0.006
HB7	8.0	1.4	0.13	0.017	0.009
HB8	5.35	1.5	0.17	xxx	0.020

CW% = **Casing Wear Percent**

CWF = **Casing Wear Factor**

FF = **Friction Factor**

Rad. HBW O/H – In. = **Radial Hardband Wear in Open Hole in Inches**

Rad. HBW CSG. – In. = **Radial Hardband Wear inside Casing in Inches**

***Lowest Test Results Reported in DEA-42 Format Casing Wear Tests**

"Casing friendly hardbanding" is the term used to describe those hardbandings that tend to protect the casing more than the drill string. They exhibit a low coefficient of friction that creates less friction during contact with other steel surfaces; consequently there is less heat and less wear. However, the term "casing friendly" can be misleading in that it only protects the casing at such time as it is contacts the casing wall the majority of the time. If the tool joint surface contacts the casing wall more than the hardbanding surface, then there is not much protection. Also, once the hardbanding surface wears flush with the tool joint surface, there will be additional friction and wear. This is what needs to be avoided. Also, these hardbandings, no matter how effective, only reduce and do not eliminate the amount of wear on the casing or other components that it comes in contact with.

Other benefits can be equally important. These hardbandings can significantly reduce the drag and torque created by the drill string while drilling and tripping in the hole.

Case histories gathered over the past 15 years prove that casing failures have practically been eliminated with the use of casing-friendly hardbandings. Certain new hardbanding materials also have improved drill pipe wear. Now wells are being drilled deeper and more horizontal in nature with drill pipe that last longer, create less casing, riser and BOP wear while creating less drag and torque downhole.

The cost of new drill pipe has soared well above the US$100/ft range and, with the increased drilling activity, delivery time for new drill pipe has stretched out to over a year from the order date. These increases make it imperative to protect the drill pipe as well as other components. The damage to the drill strings and the rise of overall costs caused by these extreme drilling conditions necessitate taking all precautions to increase the life of the drill string, including the casing, marine riser and BOP. Casing-friendly hardbanding has created the most efficient and effective method by which to do so.

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