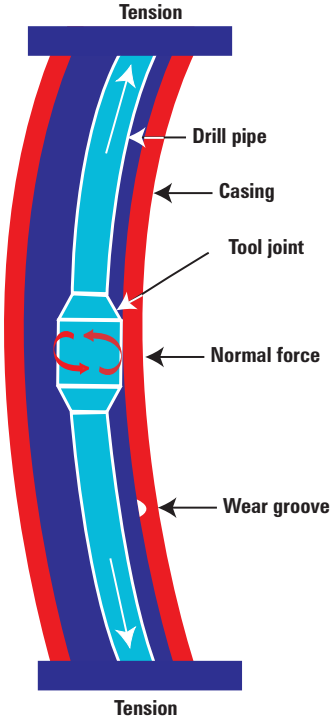
New tool-joint hardbanding aims at cutting casing damage while keeping cracks at bay

DAMAGE TO CASING caused by tool joints has long been a bone of contention between operators and drilling contractors. Now, a new tool-joint hardbanding has been developed to minimize casing damage and remain crack free while providing for easy field application. **ICO** began work on the compound in late 1998, and first tested it last March. The material represents a compromise to develop a compound optimized for medium-hard and soft formations such as in the Gulf of Mexico, explained ICO Assistant Vice President **Lloyd Charpentier**. "We gain a lot of casing-friendly features while maintaining acceptable tool-joint wear," he said.



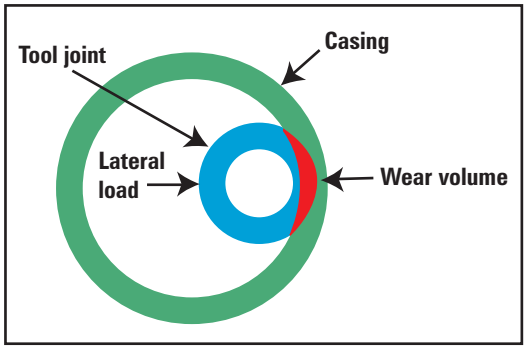
ICO worked with an alloy specialty company to develop the metallurgy for the material, called SmoothAlloy, Mr Charpentier said. The result is an iron-based allow with low carbon content. The alloy includes a minuscule amount of chrome, but is not chrome-based, Mr Charpentier said.

CASING WEAR TESTS

Casing wear occurs when drill-string tension holds the rotating tool joint against the casing, according to **Maurer Engineering**, which conducted tests on tool joints coated with the material. This produces a crescent-shaped groove in the casing. The outside of the tool joint also wears.

The wear volume is proportional to the product of the lateral load and the sliding distance with the tool-joint wear factor, according to Maurer. Consequently, the smaller the wear factor, the less damage that results. (The sliding distance equals the tool-joint circumference times the total turns of drill string.)

Maurer's casing-wear tests found that



Casing wear culprits: Casing wear occurs when drillstring tension holds the rotating tool joints against the casing, explains Maurer Engineering (left). As shown in the inset above, this contact wears a crescent-shape groove in the casing. The outside of the tool joint also wears.

SmoothAlloy significantly outperformed uncoated steel tool joints and tool joints hardbanded with spherical tungsten carbide. Maurer measured the casing wear factor, a measure of damage done by the tool joint on the casing, at 1.45 for tool joints treated with SmoothAlloy. In comparison, the figures for steel and special tungsten-treated tool joints were 5.5 and 7.6, respectively, according to Maurer.

The tests also determined the friction factor for the ICO-coated tool joint sample to be 0.18. This amounts to 10% less than that for uncoated steel tool joints (0.20) and a 20% increase over the 0.15 friction factor for spherical tungsten carbide, according to Maurer.

New hardbanding compound: Casing-wear tests found that ICO's new hardbanding compound significantly outperformed uncoated steel tool joints and those hardbanded with spherical tungsten carbide. The tests determined a wear factor for the ICO material nearly one-fourth that of the next-best performer.

The ICO sample demonstrated radial wear of the tool joint of 0.0065 in. This is 3.25 times the 0.002 value found for uncoated steel tool joints. Maurer measured the value for spherical tungsten carbide at 0.000 in., below the precision of the test.

Finally, Maurer observed no stress cracking on the ICO tool joint, either before or after testing.

Maurer says its test parameters were designed to simulate actual cased-hole drilling conditions as closely as possible. The casing was N-80, 47 lb/ft, 9 5/8-in. pipe, and the steel tool joint was 6.25 diameter. The tests were conducted in the laboratories under a lateral load of 3,000 lbf/ft at 158 rpm and a reciprocation rate of 20 ft /hr. A 10-lb/gal water-based mud was used.

FIELD APPLICATION

The material is also said to be easily field applicable. No special fluxes or gases are needed. It can be applied over previous treatments of SmoothAlloy, over tungsten carbide or to slick joints, Mr Charpentier said. He added that both the box and the pin should be hardbanded. Too often, he said, the pins are not hardbanded.

Further, Mr Charpentier says the material is cost effective, because both the cost of application and of the material are low. "Reapplication costs are also low, because the material can be reapplied without special preparation," he explained.