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 alloy 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 SmoothAlloy 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 lb/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.