

here are r_0 values, that is, they include zero-point vibration. The value for $\equiv\text{C}-\text{H}$ is probably the most accurate, that for CH the least accurate.

For benzene, which might have been expected to give a value similar to ethylene, Stoicheff¹¹ found 1.084 Å. Slightly different values for the C—H distance in methane are obtained, depending on which isotope is chosen; but they are within a few thousandths of the value given.

Similar differences have been found by several authors¹⁵ for the C—Cl, C—Br, C—I bonds, depending on whether they are adjacent to a triple bond or single bonds. But in these cases, unlike those discussed above, there is also a dependence on the adjacent atoms. A clear case of this kind is the C—F bond which, in methyl fluoride¹⁶, has the length 1.385, in fluoroform 1.332 Å.¹⁷ However, in the case of the C—C, C=C, C≡C and C—H bonds, the effect of adjacent atoms on the bond-length seems to be small compared to the effect of the adjacent bond-type.

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Corrosion Fatigue of Low-Alloy Chromium-Molybdenum Steel as affected by the State of Heat Treatment

MANUEL has shown¹ that the spheroidized zones which exist on each side of a weld in plain carbon steel are a source of accelerated corrosion in oil-well drilling tubes.

Modern hollow mining-drill steel rods possess such a spheroidized zone near the shank end. The rods are manufactured from as-rolled material, the shank end being austenitized, quenched and tempered. Thus there exists in the rod a short section containing spheroidized carbide, which occurs at the junction of the as-rolled body and the heat-treated shank. This zone can be distinguished by a marked 'valley'

in a hardness traverse carried out along the rod, by etching and by micro-examination.

Approximately 95 per cent of mining-drill steel rods in use at Kalgoorlie have the following composition: carbon 0.97 per cent, chromium 1.15 per cent, molybdenum 0.25 per cent, silicon 0.20 per cent, manganese 0.25 per cent.

In a group of fifty fractures of such rods which has been examined here, it was observed that no fracture occurred at the point of lowest hardness (the fully spheroidized section) where fatigue failure would be expected to occur. The fatigue limit of the steel with fully spheroidized carbide was estimated from tensile test results to be 66,500 lb. per sq. in. However, in the case of thirty-seven of the fractures, failure occurred at the point where spheroidization was just beginning, the stepped surface of these failures pointing to corrosion fatigue. The fatigue limit of this structure was estimated from tensile test results to be 107,300 lb. per sq. in. The source of failure in each case was at the central hole.

A ferroxy accelerated corrosion test was carried out on a scale-free shank containing a spheroidized zone, illustrated in Fig. 1 (above). It was observed that marked accelerated corrosion occurred at the spheroidized zone, as shown in Fig. 1 (below). This zone was thus more anodic than any other point on the surface, the internal hole acting as cathode in this test.

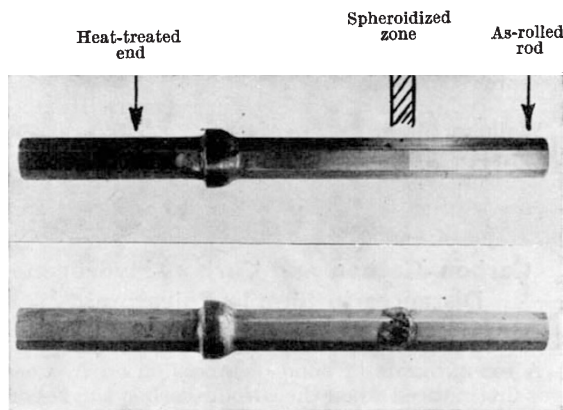


Fig. 1. Above: Shank end of drill steel, showing the junction between as-rolled rod and the heat-treated end, at which the spheroidized zone occurs

Below: Same shank as above, after immersion for seven days in ferroxy reagent. The adhering band is of agar jelly containing the complex ferrous-ferricyanide ion. This band marks the highly anodic region which corresponds to the spheroidized zone above

In practice, accelerated corrosion occurs at the spheroidized zone from the internal hole, the flushing water in this hole acting as electrolyte. The corrosion pits produced then act as stress concentrators, and failure occurs by corrosion fatigue.

Further work is proposed to investigate the effect of heat treatment on the rate of corrosion of steels covering a range of compositions, the tests including loss of weight and electrode potential measurements of samples with various structures.

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