TECHNIQUE OF MANUFACTURING DRILL RODS

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To increase the service life of drill rods a new technique of manufacturing them has been developed with use of high-frequency current in the final heat treatment. The new technique consists of: 1) ensuring the geometric dimensions of drill rod in conformity with GOST 11446-65; 2) roller burnishing of the cone after machining to obtain a surface finish ∇6-∇7 (GOST 2789-51) with a single-roller device developed at VNIITS. With this surface finish the service life of the cones increases by 35-50%; 3) induction heating for upsetting to form the collar, normalization of the shank after upsetting, quenching and tempering of the shank to a length of 20-30 mm from the end, and quenching and tempering of the cone to a length of 60-70 mm. A special device was attached to the LZ-67 high-frequency tube generator for this purpose.

A study of the drill rods prepared by the new technique with use of inductors showed that the shanks and collars have a sorbitic structure with a fine network of ferrite in the grain boundaries after normalization. The hardness of the shank at the end is HRC 45-54. The collar of the drill rod has a sorbitic structure (HRC 36-45) after quenching and tempering to a length of 60-70 mm.

An experimental batch (42 drill rods) was manufactured by the new technique. For comparison, 40 drill rods were manufactured by the existing technique. Boring tests were made in the plant with the PR-30K boring machine on rock with a hardness of 16-18 (Protod'yakonov scale).

The service life of drill rod manufactured by the experimental technique with use of high-frequency induction heating was three to four times higher than that of drill rod manufactured by the existing technique.

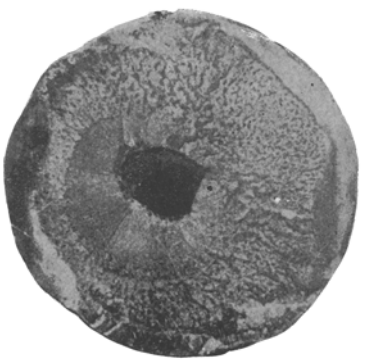

Fig. 1

Fig. 2

Fig. 1. Fracture of drill rod manufactured by new technique. 2×. It can be seen that the fracture zone begins at the surface of the washing channel.

Fig. 2. Cross section of drill rod manufactured by existing technique. 2×.

VNIITS. Moscow Automobile Factory Higher Technical School. Translated from Metallovedenie i Termicheskaya Obrabotka Metallov, No. 2, pp. 38-39, February, 1974.

Breakage of the shank decreased by a factor of three. The fractures were of the corrosion-fatigue type (Fig. 1). The focus of fracture occurred on the inner surface of the washing channel at the collar. The low fatigue strength of this section is explained by the triangular section on the inner surface (Fig. 2). Heating with a tube generator creates a large temperature differential through the section, with corresponding differences in the ductility of the surface and the inner layers of the metal, which are deformed to different degrees during manufacture. To eliminate the surface effect of high-frequency current during heating of the piece the heating time was divided into 3-4 periods with short intervals between them (4-5 sec), which equalized the temperature and ductility of the metal through the section. This prevented formation of the triangular section on the inner surface of the channel, which served as a stress concentrator and favored corrosion-fatigue failure of the drill rod. The heating was interrupted periodically by a time relay in the generator circuit.

CONCLUSIONS

1. A new technique of manufacturing drill rod has been developed and is recommended for adoption. The use of induction heating by high-frequency current is recommended for the final heat treatment. The effectiveness of this technique can be increased considerably in combination with hardening the surface by shotpeening.

2. The average service life of drill rod manufactured by the new technique with use of high-frequency heating is three to four times higher than that of drill rod manufactured by the existing technique.

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