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# Production technology of high strength reinforcement rod

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At present JSC "ZSMK" is the largest producer of building reinforcement steel in Russia. One of the most essential conditions for holding our positions on this products market is the increase of assortment and quality of rolled metal.

Under existing conditions of the medium-section mill of our ZSMK Corporation, there has been developed a new technology, and we learned to master production of 10－20 mm reinforcement rod of 28C steel grade with a flow limit 1000－1150 N/mm$^2$. Production technology includes the thermal hardening in the line of small section shop 250－2 according to the interrupted hardening mode-cycled cooling of rods with a water flow (having thereby the intermediate warming up of the surface) and a final cooling in the air environment.

Rolled metal produced in accordance with such technology has the following features: a high plasticity level ($\delta_5 \geqslant 10\%$ at $\sigma_b \sim 1350$ N/mm$^2$), conditional rate of strength and yield strength of the order $\sigma_{0.05}/\sigma_{0.2} = 0.88－0.97$ (the requirement of standard is not less than 0.85). It has also operational properties and corrosion cracking durability at mechanical load.

The physical nature of reaching of such a spectrum of mechanical properties correlates with a creating of a gradient structure in cross-section of the rod: the surface layer thickness of approximate 1.0 mm, of the intermediate layer approximate 3.5 mm and the axial zone (quantitative values are given for the reinforcement rod with diameter 20 mm). The structure of surface layer consists of high tempered martensite, and, in a large degree, it determines the mechanical and operational properties of the rolled metal. In the intermediate and axial zone the main structure components are beinite-perlite compound and ferrite at different ratio.

According to the requirements of GOST 10884 the high complex of mechanical properties of the high strengh reinforcement rod with the diameter more then 18 mm must remain after electrical heating-up and holding during an interval of 5 minutes at the temperature 400℃. The accomplished investigations showed that "layered" structure practically remains at the given temperature influence, and the loose of strength is thereby not more than ～ 4%－5%.

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