COMPANY PRESENTATION

POSSIBILITIES FOR IMPROVING THE QUALITY OF WIRE ROD

R. Schmidt

The wide use of computer technology in production processes has brought a significant improvement in the quality of all types of products and a reduction in production costs. This applies as well to rolled products, especially bars and wire rod.

The planning and design work being done on rod mills by the firm "SKET Walzwerkstechnik GmbH" (in Magdeburg) is making a significant contribution to improvements in the quality of wire rod, which depends on many different factors that figure into the design of the equipment.

The main requirements for wire rod are established by the following standards: GOST 2590-88, GOST 10702, GOST 1050-88, GOST 14 959, DIN 1013, DIN 59110, DIN 59 115, ASTM A 29/A 29 M-91, as well as government norms and specifications — in Russia, OST 14-15-37-85, TU 14-15-212-89, TU 14-15-213-89, and others. The requirements discussed below for wire rod, established by the corresponding standards and TUs, determine the competitiveness of the product in the marketplace.

Size tolerances. The standards establish the main diameters of wire rod along with the size tolerances and specifications on ovality. For example, the tolerance field is shifted toward the minus region by GOST 2590, which helps conserve metal. The tolerances demanded today by customers are often lower than the limiting values in the standards, which compels both the manufacturers and the users of rolling mills to find ways to meet these requirements. The planning and design work that has been done by the SKET company makes it possible to guarantee a reduction of roughly 50% in the tolerances relative to the DIN standard for most of the steels that are rolled on rod mills.

Requirements have also been tightened in regard to ovality: the ovality of the wire rod can be no greater than 60-80% of the diameter tolerance.

Physical properties such as ultimate tensile strength, elongation, and reduction of area are clearly specified in the standards. Customers require that these parameters be constant over the entire length of the rolled product. The physical properties are affected mainly by the temperature regime during rolling and the design and location of the cooling equipment.

The quality of the surface is determined by the course of processes involved in the formation of scale, cracks, seams, surface roughness, cavities, and fins, as well as by the degree of decarbonization and/or carbonization of the rolled products, the initial material, rolling temperature, and cooling technology. Surface quality is additionally influenced by the performance of the scale-removal equipment and the design of the passes, guides, and guards. More stringent standards must be met by wire intended for metal cord and thin cables, as well as by steels for cold upsetting and spring steels. Despite the extra treatments that are administered, the quality of spring steel depends to a significant extent on the quality of the surface and the strength properties of the wire rod.

The structure of the metal must be precisely stipulated. If the material conforms to the standards, energy can be saved for subsequent treatments of the product. It is increasingly important to observe the proper elongation conditions (the degree of deformation across the product should be within the range 85-95% in the case of cable wire) and, in steels for cold upsetting, to obtain a structure that will allow large deformations in the cold state without heat treatment.

The strict requirements mentioned above in regard to the quality of wire rod have made it necessary to develop new, modern equipment, monitoring instruments, and control systems.
Fig. 1. Single-strand rod mill: 1) furnace section; 2) section of working stands; 3) finishing block; 4) laying reel; 5) coil conveyor; 6) rod finishing section.

Fig. 2. Two-strand rod mill: 1) furnace section; 2) walking-beam furnace; 3) roughing set; 4, 5) intermediate sets I and II, respectively; 6) finishing block; 7) coil conveyor; 8) "power and free" hook transfer.

Fig. 3. Two-strand rod mill for large billets: 1) pallet conveyor system; 2) water-air cooling section; 3) finishing blocks; 4, 5) intermediate sets II and I, respectively; 6) free discharge; 7) roughing set; 8) walking-beam furnace; 9) billet-charging section.

Requirements for modern rod mills

Today, rod mills must be designed so that they satisfy cost-efficiency standards as well as production standards by doing the following: permitting rapid roll changes for the production of small batches of different shapes; keeping production costs low, particularly by reducing power consumption for the main process, conserving materials, and providing a high degree of reliability; allowing the production of heavy coils of wire rod while keeping properties constant over the entire length of the rod. These criteria, rather than maximizing productivity and rolling speed, are now the most important criteria. This naturally leads to the following question: is it cost-effective to modernize mills built during the period 1960-1980?

Such mills typically have four strands in the roughing and intermediate sets and a single strand in the finishing set, which consists of two and four stands; located behind the latter are Garrett reelers and coil conveyors. The cross section of the initial semifinished product (billet) is 80 × 80 - 100 × 100 mm, while the weight of the coils is 300-600 kg. Most of these mills have been modernized so as to allow an increase in the cross section of the billet; water cooling has also been provided after the finishing sets. An air cooling unit has also been installed in order to make use of the Stellmore technology.